

2016-2017 Antimicrobial Guide

**Empiric Therapy & Treatment
Recommendations For Adult
Patients**

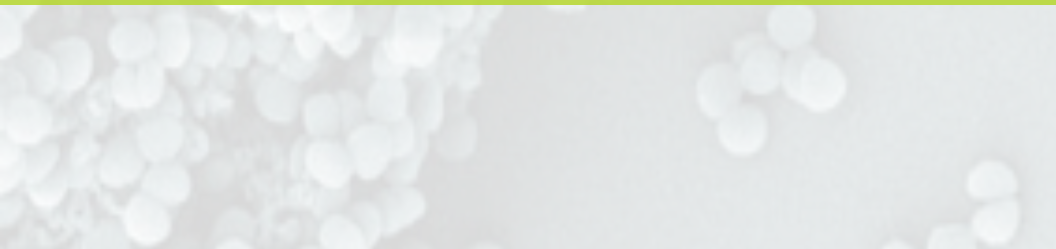


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Introduction

Antimicrobial resistance is globally recognized as one of the greatest healthcare threats. Infections associated with multi-drug resistant organisms and limited antimicrobial choices have placed an immense burden upon clinicians. In order to preserve currently available antimicrobials we must use them appropriately; ensuring that each patient is on the right drug, route, dose, and duration.

The pathways and tables in this booklet are based on national guidelines and consensus statements, expert opinions from the Infectious Diseases team (pharmacy and medicine) and microbiology data from the microbiology laboratory.

DISCLAIMER: The opinions expressed in this publication reflect those of the authors to the best of their ability. However, the authors make no warranty regarding the contents of the publication. The guidelines described herein are general and may not apply to a specific patient.

The recommendations given in this guide are meant to serve as treatment guidelines. They should not replace clinical judgment or Infectious Diseases consultation when indicated. The recommendations may not be appropriate at other settings. We have attempted to verify that all information is correct but because of ongoing research, recommendations may change.

Please let us know if there are sections that you think could be improved or if there is more information you would like to see included. Our goal is for the Antimicrobial Stewardship Program to be a useful service in optimizing antibiotic use and patient outcomes.

We welcome your thoughts and comments.

Thank you,

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Central Nervous System: Meningitis

ACUTE BACTERIAL MENINGITIS

Clinical Syndrome	Preferred Regimen	Alternative Regimen	Diagnostics and Clinical Considerations
Age < 50 Most commonly isolated organisms: <ul style="list-style-type: none"> <i>S. pneumoniae</i> <i>N. meningitidis</i> <i>H. influenzae</i> 	Ceftriaxone 2 gm IV Q12H AND Vancomycin 15 mg/kg IV Q6H AND Dexamethasone 0.15 mg/kg IV Q6H given 10 to 20 minutes <u>before</u> the first dose of antimicrobial therapy and continue for 4 days for pneumococcal meningitis (discontinue for all other microorganisms)	<u>PCN allergy (anaphylaxis):</u> Vancomycin 15 mg/kg IV Q24H AND Moxifloxacin 400 mg IV Q24H AND Dexamethasone 0.15 mg/kg IV Q6H given 10 to 20 minutes <u>before</u> the first dose of antimicrobial therapy and continue for 4 days for pneumococcal meningitis (discontinue for all other microorganisms)	<ul style="list-style-type: none"> <u>Consult Infectious Diseases</u> Obtain lumbar puncture and blood cultures <u>prior</u> to starting therapy Patients with the following conditions should receive head CT prior to lumbar puncture: <ul style="list-style-type: none"> Immuno-compromised (HIV) History of CNS lesion, stroke or focal infection New onset seizure Papilledema Abnormal level of consciousness Focal neurologic deficit Typical CSF findings in bacterial meningitis <ul style="list-style-type: none"> Cloudy CSF Glucose < 40 mg/dL OR <50% serum Protein 100-500 WBC 1000-5000 > 90% PMNs Narrow therapy based on CSF culture results If CSF culture negative, consult ID Repeat lumbar puncture if no improvement in 48 hours and consider viral panel
Age ≥ 50 Most commonly isolated organisms: <ul style="list-style-type: none"> <i>S. pneumoniae</i> <i>N. meningitidis</i> <i>H. influenzae</i> <i>L. monocytogenes</i> Aerobic gram negative bacilli 	Ceftriaxone 2 gm IV Q12H AND Vancomycin 15 mg/kg IV Q6H AND Ampicillin 2 gm IV Q4H AND Dexamethasone 0.15 mg/kg IV Q6H given 10 to 20 minutes <u>before</u> the first dose of antimicrobial therapy and continue for 4 days for pneumococcal meningitis (discontinue for all other microorganisms)	<u>PCN allergy (anaphylaxis):</u> Vancomycin IV 15 mg/kg Q24H AND Moxifloxacin 400 mg IV Q24H AND SMX/TMP 5 mg/kg IV Q6H AND Dexamethasone 0.15 mg/kg IV Q6H given 10 to 20 minutes <u>before</u> the first dose of antimicrobial therapy and continue for 4 days for pneumococcal meningitis (discontinue for all other microorganisms)	

CNS= central nervous system; CSF= cerebral spinal fluid; CT= computed tomography; H= hour(s); HIV= human immunodeficiency virus; ID= infectious diseases; IV= intravenous; PCN= Penicillin; PMNs= poly morphonuclear cells; Q= every; SMX/TMP= Sulfamethoxazole/Trimethoprim; WBC= white blood cell

Central Nervous System: Meningitis

ASEPTIC/ VIRAL/OTHER MENINGITIS AND HERPES SIMPLEX TYPE 2

Clinical Syndrome	Preferred Regimen	Diagnostics and Clinical Considerations
Aseptic/Viral/Other <ul style="list-style-type: none"> • Respiratory viruses • Enteroviruses (90%) • Arboviruses • West Nile Virus • Epstein Barr Virus • Lyme • Syphilis 	Supportive care If Lyme Suspected: Ceftriaxone 2 gm IV Q24H	<ul style="list-style-type: none"> • <u>Consult Infectious Diseases</u> • Send CSF and order: <ul style="list-style-type: none"> - Viral culture - HSV PCR - Enteroviral PCR - Lyme Antibody (IgG index, requires simultaneous serum) - VDRL • Typical CSF findings in viral meningitis <ul style="list-style-type: none"> - Clear CSF - Glucose 30-70 mg/dL - Protein 30-150 - WBC 100-1000 - < 90% PMNs, increased lymphocytes
Herpes Simplex Type 2	Acyclovir 10 mg/kg* IV Q8H Treat for 7 to 10 days	

CSF= cerebral spinal fluid; H= hour(s); HSV= Herpes Simplex Virus; IV= intravenous; LP= lumbar puncture; PCR= Polymerase Chain Reaction; PMNs= poly morphonuclear cells; Q= every; VDRL= Veneral Disease Research Laboratory Test; WBC= white blood cell

* Acyclovir mg/kg dosing based on ideal body weight.

NOTE: *If dexamethasone or imaging studies (LP or CT) is not immediately available DO NOT delay administration of antibiotics.*

NOTE: *Dosing based on normal renal function. Refer to Table of Contents for section on Vancomycin Dosing and Monitoring in Adult Patients and Antimicrobial Dosing for Adult Patients Based on Renal Function*

References:

1. Tunkel AR, et al. Practice guidelines for the management of bacterial meningitis. *Clin Infect Dis*. 2004 Nov 1;39(9):1267-84.

Clostridium difficile Infection (CDI)

- Stop antibiotics that are no longer indicated, especially broad-spectrum antibiotics (fluoroquinolones, clindamycin, piperacillin-tazobactam, cephalosporins) as they increase the risk for CDI
- Stop use of any anti-diarrheal/antiperistaltic agents
- Consider discontinuation of proton-pump inhibitors (PPIs)
- If high clinical suspicion of CDI initiate antibiotic therapy before laboratory confirmation

INITIAL EPISODE			
Clinical Classification	Supportive Clinical Data	Recommended Regimens	Clinical and Therapeutic Considerations
Initial episode Mild or Moderate	<ul style="list-style-type: none"> • Diarrhea (passage of ≥ 3 unformed stools in ≤ 24H) <p>AND</p> <ul style="list-style-type: none"> • WBC $< 15,000$ cells/μL <p>AND</p> <ul style="list-style-type: none"> • SCr < 1.5 times the premorbid level 	Vancomycin* 125 mg PO Q6H for 10-14 days	Ensure loose stools are not a result of laxative
Severe	<ul style="list-style-type: none"> • Diarrhea <p>AND</p> <ul style="list-style-type: none"> • WBC $\geq 15,000$ cells/μL <p>OR</p> <ul style="list-style-type: none"> • SCr ≥ 1.5 times the premorbid level 	Vancomycin 125 mg PO Q6H for 10-14 days	Consult ID and Surgery Start supportive care as needed: <ul style="list-style-type: none"> • IV fluid resuscitation • Electrolyte replacement
Complicated Severe	Severe criteria PLUS ≥ 1 of the following: <ul style="list-style-type: none"> • Hypotension • Shock • Toxic Megacolon • Perforation • Ileus 	<p>If no complete ileus: Oral vancomycin 500 mg PO Q6H OR via NG tube AND if micro perforation is suspected metronidazole 500 mg IV Q8H</p> <p>If complete ileus: Add vancomycin retention enema 500 mg in 500 mL NS Q6H</p> <p>Treatment duration: 14 days</p>	

CDI= Clostridium difficile Infection; H= hour(s); ID= Infectious Diseases; IV= intravenous; NG= nasogastric; NS= normal saline; PO= by mouth; PPI= proton pump inhibitor; Q= every; SCr= Serum Creatinine; WBC= white blood cell

* This recommendation is based on a Medication Use Evaluation which showed a higher rate of recurrence with metronidazole

Clostridium difficile Infection (CDI)

RECURRENT EPISODES

No. of Recurrences	Recommended Regimens
1st Recurrence	Vancomycin* 125 mg PO Q6H for 10-14 days
2nd Recurrence	Consult ID for tailoring antibiotic therapy. Oral vancomycin tapered over 6 weeks and/or pulse dosing <u>Vancomycin Taper Regimen:</u> 125 mg PO Q6H for 14 days 125 mg PO Q12H for 7 days 125 mg PO once daily for 7 days 125 mg PO every other day for 8 days 125 mg PO every 3 days for 15 days If Severe : Consider Fidaxomicin 200 mg PO Q12H (ID Restricted)
≥ 3 recurrences	Consult ID team <ul style="list-style-type: none"> • Possible referral for fecal microbiota replacement therapy² • Consider restarting vancomycin taper OR Fidaxomicin 200 mg PO Q12H (ID Restricted)^{3,4}

RISK FACTORS FOR CDI

<ul style="list-style-type: none"> • ≥ 64 years of age • Exposure to antibiotics in previous 90 days • Hospitalization in previous 30 days • Recent GI surgery 	<ul style="list-style-type: none"> • Exposure to CDI (household family member with CDI) • Long-term care facility or nursing home resident • Gastric acid reducing agent (proton-pump inhibitors) • Tube feedings
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INFECTION CONTROL

<ul style="list-style-type: none"> • Routine screening for <i>C. difficile</i> in hospitalized patients without diarrhea is not recommended • Asymptomatic carriers should not be treated • Patients should be placed in a private room or with other patients who have CDI • Initiate contact precautions for patients positive with CDI until 48 hours from resolution of symptoms <ul style="list-style-type: none"> • Place contact precautions plus sign on patient's door • Hand hygiene and barrier precautions (gloves and gowns) • Place dedicated stethoscope in patient's room • When patient discharged or symptoms resolve, room should be terminally cleaned

MISCELLANEOUS

<ul style="list-style-type: none"> • Repeat CDI PCR testing not recommended due to the likelihood of false positives. Toxin A, B, and TC may remain positive for as long as 30 days in patient with symptom resolution.
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CDI= Clostridium difficile infection; GI= gastrointestinal; H= hour(s); ID= Infectious Diseases; PCR= Polymerase Chain Reaction; PO= by mouth; Q= every; TC= Toxigenic Culture

* This recommendation is based on a Medication Use Evaluation which showed a higher rate of recurrence with metronidazole

References:

1. Cohen, SH, et al. SHEA-IDSA Clinical Practice Guidelines for *Clostridium difficile* Infection in adults. ICHE. 2010 May; 31(5): 431-55.
2. Surawicz CM, et al. Guidelines for Diagnosis, Treatment, and Prevention of *Clostridium difficile* Infections. *Am J Gastroenterol* 2013; 108:478–98.
3. Kim PK, et al. Intracolonic Vancomycin for severe clostridium difficile colitis. *Surg Infect (Larchmt)*. 2013 Dec; 14(6):532-9.
4. Louie T, et al. Fidaxomicin versus Vancomycin for *Clostridium difficile* Infection. *N Engl J Med*. 2011 Feb 3;364(5):422-31.
5. Cornely OA, et al. Fidaxomicin versus vancomycin for infection with *Clostridium difficile* in Europe, Canada, and the USA: a double-blind, non-inferiority, randomised controlled trial. *Lancet Infect Dis* 2012; 12: 281–9.

Extended Spectrum Beta-Lactamase (ESBL) Infection

CLINICAL SYNDROME	PREFERRED REGIMEN	ALTERNATIVE REGIMEN	CLINICAL CONSIDERATIONS
Extended Spectrum Beta-Lactamase (ESBL) Infection	Meropenem 2 gm IV Q8H (Use maximum doses)	Consult ID Consult ID	Please DO NOT treat colonization, or a “dirty urine” sample
Carbapenem-resistant Enterobacteriaceae (CRE)	Consult ID		

Febrile Neutropenia

CLINICAL SYNDROME	PREFERRED REGIMEN	ALTERNATIVE REGIMEN	CLINICAL CONSIDERATIONS
Febrile Neutropenia High risk: anticipated prolonged (>7 days duration) AND profound neutropenia (ANC ≤100 cells/mm ³ following cytotoxic chemotherapy) +/- significant co-morbid conditions: hypotension, pneumonia, new-onset abdominal pain, or neurologic changes	Cefepime 2gm IV Q8H OR Piperacillin/tazobactam 3.375gm IV Q4H (18gm/day)	Meropenem 1 gm IV Q8H	If patient has indwelling catheter, is persistently febrile OR previously colonized with MRSA: ADD vancomycin Consult ID for Anti-fungal therapy; Consider when fever fails to respond after 3-7 days of therapy

ANC= Absolute neutrophil count; CRE= Extended Spectrum Beta-Lactamase; ESBL= Extended Spectrum Beta-Lactamase; H= hour(s); ID= Infectious Diseases; IV= intravenous; MRSA= Methicillin-Resistant *S. aureus*; Q= every

NOTE: Dosing based on normal renal function. Refer to Table of Contents for section on Antimicrobial Dosing for Adult Patients Based on Renal Function, Aminoglycoside High Dose Once Daily (HDOD) and Monitoring in Adult Patients, and Vancomycin Dosing and Monitoring in Adult Patients.

Fungal Infections

CONDITION	PRIMARY THERAPY	ALTERNATIVE THERAPY	DURATION	COMMENTS
Candidemia Non-neutropenic	Caspofungin IV LD: 70 mg MD: 50 mg Q24H <u>OR</u> Fluconazole IV LD: 800 mg (12mg/kg) MD: 400 mg 6 mg/kg) Q24H	L-AmB 3–5 mg/kg IV Q24H <u>OR</u> Voriconazole IV/PO 400 mg (6 mg/kg) Q12H for 2 doses then 200 mg (3 mg/kg) Q12H	14 days after first negative culture result <u>AND</u> resolution of signs/symptoms	Remove all IV catheters, if possible Consult ID Consider eye exam Transition to fluconazole is recommended for <i>clinically stable</i> patients with fluconazole susceptible isolates <u>AND</u> negative repeat blood cultures
Candidemia Neutropenic	Caspofungin IV LD: 70 mg MD: 50 mg Q24H <u>OR</u> L-AmB 3–5 mg/kg IV Q24H	Fluconazole IV LD: 800 mg (12 mg/kg) MD: 400 mg (6 mg/kg) Q24H <u>OR</u> Voriconazole IV/PO 400 mg (6 mg/kg) Q12H for 2 doses then 200 mg (3 mg/kg) Q12H	14 days after first negative culture result <u>AND</u> resolution of signs/symptoms and neutropenia	Fluconazole is preferred in patients without recent azole exposure <u>AND</u> who are <u>NOT</u> critically ill. Remove IV catheters, if possible Consult ID Consider eye exam
Urinary Candidiasis Symptomatic Cystitis	Fluconazole 200 mg (3 mg/kg) PO Q24H	Conventional Amphotericin B 0.3–0.6 mg/kg IV Q24H	Fluconazole: 14 days Amphotericin B: 1–7 days	Alternative treatment is recommended for fluconazole resistant organisms
Urinary Candidiasis Pyelonephritis	Fluconazole 200–400 mg (3–6 mg/kg) PO Q24H	Conventional Amphotericin B 0.5–0.7 mg/kg IV Q24H	Fluconazole: 14 days Amphotericin B: 14 days	Alternative treatment is recommended for fluconazole resistant organisms

H= hour(s); ID= Infectious Diseases; IV= intravenous; L-AmB= Liposomal Amphotericin B; LD= loading dose; MD= maintenance dose; PO= by mouth; Q= every

NOTE: Some agents will require ID consult/approval (amphotericin B, caspofungin, voriconazole). Refer to Table of Contents for section on Guidelines for Restricted Antibiotics

References:

- Pappas PG, et al. Clinical Practice Guideline for the Management of Candidiasis: 2016 Update by the Infectious Diseases Society of America. *Clin Infect Dis*. 2016; 62(4):e1–e50.

Fungal Infections

CONDITION	PRIMARY THERAPY	ALTERNATIVE THERAPY	DURATION	COMMENTS
Nongenital Oropharyngeal (Oral Thrush)	Clotrimazole 10 mg troche 5 times daily OR Nystatin suspension PO four times a day OR Fluconazole 100–200 mg PO once daily	Itraconazole oral solution 200 mg PO once daily OR Voriconazole 200 mg PO Q12H	Uncomplicated disease 7 to 14 days	Refractory disease: Voriconazole 200 mg PO Q12H OR L-AmB suspension 1 mL of 100 mg/mL four times a day
Esophageal Candidiasis	Fluconazole 200–400 mg (3–6 mg/kg) PO Q24H	Caspofungin IV LD: 70 mg MD: 50 mg Q24H OR Conventional Amphotericin B 0.3–0.7 mg/kg IV Q24H	14–21 days	Patients unable to tolerate an oral agent, IV fluconazole or alternative agent listed may be used.

General Susceptibility Patterns of *Candida* spp.

	Fluconazole	Itraconazole	Amphotericin B	Caspofungin	Voriconazole
<i>Candida albicans</i>	S	S	S	S	S
<i>C. tropicalis</i>	S	S	S	S	S
<i>C. parapsilosis</i>	S	S	S	S	S
<i>C. glabrata</i>	S-DD	S-DD to R	S-I	S	S-DD to R
<i>C. krusei</i>	R	S-DD to R	S-I	S	S
<i>C. lusitanae</i>	S	S	S to R	S	S

H= hour(s); I= Intermediate; IV= intravenous; L-AmB= Liposomal Amphotericin B; LD= loading dose; MD= maintenance dose; PO= by mouth; Q= every; R= Resistant; S= susceptible; S-DD= Susceptibility is dose dependent; spp= species

NOTE: Some agents will require ID consult/approval (amphotericin B, caspofungin, voriconazole). Refer to Table of Contents for section on Guidelines for Restricted Antibiotics

References:

- Pappas PG, et al. Clinical Practice Guideline for the Management of Candidiasis: 2016 Update by the Infectious Diseases Society of America. *Clin Infect Dis*. 2016; 62(4):e1–e50.

Influenza A and B (Flu)

CLINICAL AND THERAPEUTIC ALGORITHM	CLINICAL SEVERITY	RECOMMENDED REGIMENS
<p>Diagnosis is based on the clinical presentation of the patient and results of RT-PCR.</p> <p>Decision to initiate treatment should NOT wait for confirmation of laboratory results.</p> <p>Continue the full course of treatment if first RT-PCR is negative and if signs and symptoms indicate influenza due to possibility of false negative.</p> <p>History of influenza vaccination does not preclude influenza when signs and symptoms are compatible with the clinical syndrome.</p> <p>Zanamivir use is not recommended in people with underlying respiratory disease (e.g. asthma, COPD.)</p> <p>Treatment Population:</p> <p>High risk adults (any of the following):</p> <ul style="list-style-type: none"> • ≥65 years • Chronic health conditions* • Immunosuppression, including caused by medication or HIV infection • Pregnant or postpartum (within 2 weeks of delivery) women • American Indian/Alaska Natives • Body mass index ≥40 • Residents of nursing homes and other chronic-care facilities <p>Previously healthy, symptomatic outpatient NOT at high risk (within 48 hours of symptom onset)</p> <p>Hospitalized patients CDC Flu health advisory February 2016:² Treatment may also be beneficial when started up to 4 to 5 days after symptom onset in hospitalized patients.</p>	<p>Outpatient High Risk (see left panel)</p>	<p>Select <u>ONE</u> of the following:</p> <ul style="list-style-type: none"> • Oseltamivir 75 mg PO Q12H • Zanamivir 10 mg (two 5 mg inhalations) Q12H <p>Treat for 5 days ONLY if treatment can be initiated within 48 hours of illness onset.</p>
	<p>Previously Healthy</p>	
	<p>Inpatient High Risk (see left panel)</p>	<ul style="list-style-type: none"> • Oseltamivir 75 mg PO or enterally-administered Q12H <p>Treat for 5 days. If illness is severe or prolonged, may extend duration based on clinical judgment.</p>
	<p>Inpatient</p>	<ul style="list-style-type: none"> • Oseltamivir 75 mg PO or enterally-administered Q12H <p>Treat for 5 days.</p>
	<p>Post-Exposure Chemoprophylaxis</p> <ul style="list-style-type: none"> • High risk (see left panel) 	<p>Select <u>ONE</u> of the following:</p> <ul style="list-style-type: none"> • Oseltamivir 75 mg PO once daily • Zanamivir 10 mg (two 5 mg inhalations) once daily <p>Treat for 10 days**</p>

CDC= Centers for Disease Control and Prevention; COPD= chronic obstructive pulmonary disease; H= Hour(s); HIV= human immunodeficiency virus; PO= by mouth; Q= every; RT-PCR= reverse transcriptase polymerase chain reaction

*Chronic pulmonary (including asthma), cardiovascular (except hypertension alone), renal, hepatic, hematological (including sickle cell disease), metabolic disorders (including diabetes mellitus), neurologic conditions (disorders of the brain, spinal cord, nerve, muscle, epilepsy, stroke, or intellectual disability)

**After most recent known exposure to a close contact known to have influenza.

NOTE: Dosing based on normal renal function. Refer to Table of Contents for section on Antimicrobial Dosing for Adult Patients Based on Renal Function

References:

1. Centers for Disease Control and Prevention. CMV home. Cytomegalovirus (CMV) and Congenital CMV infection Web site. <http://www.cdc.gov/cmv/clinical/features.html>. Published 6 Dec 2016. Updated 2010. Accessed 6 March 2016.
2. Department of Health and Human Services. Flu season begins: Severe influenza illness reported. Centers for Disease Control and Prevention: Emergency Preparedness and Response Web site. <http://emergency.cdc.gov/han/han00387.asp>. Published 1 Feb 2016. Updated 2016. Accessed 12 March 2016.

Intra-abdominal Infections

CLINICAL SYNDROME	PREFERRED REGIMEN	ALTERNATIVE REGIMEN	CLINICAL CONSIDERATIONS
Intra-abdominal Infections Community acquired <u>OR</u> Hospital acquired	Piperacillin/tazobactam 3.375 gm IV Q6H	Ciprofloxacin 400 mg IV Q12H +/- Metronidazole 500 mg IV Q8H Meropenem 1gm Q8H	Piperacillin/tazobactam provides excellent anaerobic coverage, addition of clindamycin <u>OR</u> metronidazole is <u>NOT</u> indicated or necessary

Lyme Disease

CLINICAL SYNDROME	PREFERRED REGIMEN	ALTERNATIVE REGIMEN	CLINICAL CONSIDERATIONS
Lyme Disease Early disease Late disease with central <u>OR</u> peripheral nervous system disease	Doxycycline 100 mg PO Q12H* <u>OR</u> Amoxicillin 500 mg PO Q8H* <u>OR</u> Cefuroxime 500 mg PO Q12H* Consult ID	Consult ID	Relapse may occur with any regimen; patients with objective signs/symptoms may need a second course Duration of Treatment: Doxycycline 10-21 days Amoxicillin/Cefuroxime 14-21 days Lyme antibody testing can be negative in first 6 weeks Consider co-infection with anaplasma or babesia

H= hour(s); ID= Infectious Diseases; IV= intravenous; PO= By Mouth; Q= every

*Doxycycline also has activity against *Ehrlichia* and *Anaplasma*. Amoxicillin and cefuroxime do not.

NOTE: Dosing based on normal renal function. Refer to Table of Contents for section on Antimicrobial Dosing for Adult Patients Based on Renal Function, Aminoglycoside High Dose Once Daily (HDOD) and Monitoring in Adult Patients, and Vancomycin Dosing and Monitoring in Adult Patients.

Proton-Pump Inhibitor (PPI) Use

The FDA has issued multiple warnings on the long-term use of PPIs. These include: increased risk of *C. difficile* infection¹, hypomagnesemia², and fractures of the hip, wrist, and spine³. Therefore, prudent prescribing of PPIs is warranted. The FDA recommends use of the lowest dose and shortest duration of PPI therapy appropriate for the condition being treated¹⁻³. Patient compliance, time of administration (prior to meals), and dietary indiscretions (i.e. alcohol or irritating foods) should be assessed prior to titration of PPI doses.

Indication	Treatment	Duration
Gastroesophageal reflux disease (GERD)⁶ Symptomatic relief Acute healing of erosive or ulcerative esophagitis Maintenance healing of erosive or ulcerative esophagitis	Omeprazole 20 mg PO once daily OR Pantoprazole 40mg PO once daily	Initial 8 week course for symptom relief or esophagitis Maintenance therapy determined by response and severity of disease Consider dose titration, or intermittent therapy
Stress ulcer prophylaxis should be used for critically ill patients <i>with increased risk of bleeding</i> including ^{4,5} : <ul style="list-style-type: none"> - Coagulopathy (platelet count <50,000 mm³, INR >1.5, or aPTT >2x control) - Mechanical ventilation for >48 hours - Traumatic, severe thermal or spinal cord injury - History of GI ulceration or bleeding within past year Two or more minor risk factors: <ul style="list-style-type: none"> - Sepsis, ICU stay ≥1 week, occult GI bleeding ≥6 days, glucocorticoid therapy (>250 mg hydrocortisone equivalent) 	Omeprazole 10-20 mg IV/PO once daily OR Pantoprazole 40mg IV/PO once daily	Transition to PO when possible Continue until resolution of underlying risk factors and/or critical illness

aPTT= activated partial thromboplastin time; GERD= Gastroesophageal reflux disease; GI= Gastrointestinal; ICU= intensive care unit; INR= International normalized ratio; IV= intravenous; PO= by mouth; PPI= proton pump inhibitor

References

1. U.S. Food and Drug Administration (FDA). FDA Drug Safety Communication: Clostridium difficile-associated diarrhea can be associated with stomach acid drugs known as proton pump inhibitors (PPIs) [internet]. Updated May 2012 [cited 11/21/12]. Available from: <http://www.fda.gov/Drugs/DrugSafety/ucm290510.htm>
2. U.S. Food and Drug Administration (FDA). FDA Drug Safety Communication: Low magnesium levels can be associated with long-term use of Proton Pump Inhibitor drugs (PPIs) [internet]. Updated February 2012 [cited 11/21/12]. Available from: <http://www.fda.gov/Drugs/DrugSafety/ucm245011.htm>.
3. U.S. Food and Drug Administration (FDA). FDA Drug Safety Communication: Possible increased risk of fractures of the hip, wrist, and spine with the use of proton pump inhibitors [internet]. Updated March 2011 [cited 11/21/12]. Available from: <http://www.fda.gov/Drugs/DrugSafety/PostmarketDrugSafetyInformationforPatientsandProviders/ucm213206.htm>
4. ASHP Therapeutic Guidelines on Stress Ulcer Prophylaxis. ASHP Commission on Therapeutics and approved by the ASHP Board of Directors on November 14, 1998. *Am J Health Syst Pharm* 1999; 56:347.
5. Spirt MJ, Stanley S. Update on stress ulcer prophylaxis in critically ill patients. *Crit Care Nurse* 2006; 26:18.
6. Katz PO, Gerson LB, Vela MF. Guidelines for the diagnosis and management of gastroesophageal reflux disease. *Am J Gastroenterol* 2013;108:308-28.

Respiratory Tract: Acute Bacterial Sinusitis

CLINICAL AND THERAPEUTIC ALGORITHM	RISK FACTORS	RECOMMENDED REGIMENS
<p>1a. Antibiotics are indicated if the patient has <u>ANY</u> of the following:</p> <ul style="list-style-type: none"> Symptoms lasting ≥ 10 days without clinical improvement <p>OR</p> <ul style="list-style-type: none"> Severe symptoms at onset lasting ≥ 3 days [Fever ($\geq 102^\circ\text{F}$), severe facial pain, or purulent discharge] <p>OR</p> <ul style="list-style-type: none"> New onset fever, severe headache, or increase nasal discharge after 5-6 days following initial improvement 	<p>Presence of Risk Factors for Antibiotic Resistance:</p> <ul style="list-style-type: none"> Age > 65 Antibiotics within last 30 days Hospitalization within last 5 days Immuno-compromised <p>OR</p> <ul style="list-style-type: none"> Fever $> 102^\circ\text{F}$ with signs of systemic illness 	<p>Initial Empiric Antibiotic Therapy:</p> <p>Amoxicillin/clavulanate PO:</p> <p>CrCl > 30 ml/min: 2000/125 mg[‡] Q12H CrCl $10 - 29$ ml/min: 875/125 mg Q12H CrCl < 10 ml/min: 2000/125[‡] mg Q24H</p> <p>Alternatives*:</p> <p>Moxifloxacin 400 mg PO Q24H</p> <p>Treat for 7 to 10 days</p>
<p>1b. If the patient does not meet this criteria likely viral and self-limiting. May provide symptom relief.</p> <ul style="list-style-type: none"> Reduce nasal symptoms: topical or nasal decongestants, intranasal corticosteroids, intranasal saline <p>2. If no improvement after 3 to 5 days of antibiotic therapy switch to an alternative agent from a different antibiotic class</p>	<p>None of the above risk factors for antibiotic resistance</p> <p>AND</p> <p>No fever or signs of systemic illness</p>	<p>No risk for Antibiotic Resistance:</p> <p>Amoxicillin/clavulanate PO:</p> <p>CrCl > 30 ml/min: 875/125 mg Q12H CrCl $10 - 29$ ml/min: 500/125 mg Q12H CrCl < 10 ml/min: 875/125 mg Q24H</p> <p>Alternatives*:</p> <p>Doxycycline 100 mg PO Q12H</p> <p>OR</p> <p>Moxifloxacin 400 mg PO Q24H</p> <p>Treat for 5 to 7 days</p>

CrCl= creatinine clearance; H= hour(s); PO= by mouth; Q= every

[‡] Pharmacy does not carry amoxicillin/clavulanate 2000/125 mg tablets. Order 875/125 mg tablets of amoxicillin/clavulanate **AND** 1000 mg tablets of amoxicillin (total amoxicillin/clavulanate = 1,875/125 mg per dose).

*Macrolides, trimethoprim-sulfamethoxazole, and 2nd or 3rd generation cephalosporins are not recommended due to increasing rates of antimicrobial resistance.

References:

1. Chow AW, Benninger MS, Brook I, et al. IDSA clinical practice guideline for acute bacterial rhinosinusitis in children and adults. *Clin Infect Dis*. 2012; 54:e72.

Respiratory Tract: Acute Pharyngitis

QUICK FACTS¹⁻²:

- Only 5-15% of adult cases of acute pharyngitis are caused by Group A β -hemolytic streptococci (GAS).
- It is estimated that 3,000 to 4,000 patients with GAS must be treated for every 1 case of acute rheumatic fever prevented.
- Antibiotic therapy of GAS hastens resolution by 1-2 days if initiated within 2-3 days of symptom onset.

CLASSIFICATION	CLINICAL PRESENTATION	RECOMMENDED REGIMENS	CLINICAL CONSIDERATIONS
Group A β-hemolytic streptococcus (GAS)	≥ 2 of the following: <ul style="list-style-type: none"> • Fever ($\geq 100.4^\circ$) • Tonsillar exudates • No cough • Tender anterior cervical lymphadenopathy (lymphadenitis) • Scarletiform rash 	Amoxicillin 500 mg PO Q12H <u>OR</u> Penicillin VK 250 mg Q6H <u>OR</u> 500 mg PO Q12H For 10 days <u>Penicillin Allergy</u> Non-anaphylactic allergy: Cephalexin 500 mg PO Q12H x 10 days <u>OR</u> Clindamycin 300 mg PO Q6H for 10 days <u>OR</u> Azithromycin 500 mg PO x 1 day, then 250 mg PO Q24H x 4 days	Clinical suspicion for GAS: Obtain throat swab <u>OR</u> order GAS rapid antigen detection test (RADT)* If culture is negative: No antibiotics <u>AND</u> consider supportive treatment (antipyretic <u>OR</u> analgesic)
Viral Pharyngitis	<ul style="list-style-type: none"> • Conjunctivitis • Coryza • Cough • Diarrhea • Hoarseness • Discrete ulcerative stomatitis • Viral exanthema 	Supportive treatment (antipyretic <u>OR</u> analgesic)	

GAS= Group A β -hemolytic Streptococci; H= hour(s); PO= by mouth; Q= every; RADT= Rapid antigen detection test

*Throat swab culture sensitivity: 90-95%; RADT: sensitivity 70-90%, specificity 95%

References:

1. Shulman ST, Bisno AL, Clegg HW, et al. Clinical Practice Guidelines for the Diagnosis and Management of Group A Streptococcal Pharyngitis: 2012 Update by the Infectious Diseases Society America. *Clin Infect Dis*. 2012 Nov 15;55(10):1279-82.
2. Cooper RJ et al. Principles of appropriate antibiotic use for acute pharyngitis in adults: Background. *Annals of Internal Medicine*. 2001;134(6):509-17.

Respiratory Tract: Chronic Obstructive Pulmonary Disease (COPD) Exacerbation

CLINICAL AND THERAPEUTIC ALGORITHM	CLINICAL SEVERITY	RECOMMENDED REGIMENS
<p>Diagnosis: Based on the clinical presentation of the patient, including complaints of an acute change of cardinal symptoms as follows:</p> <p>Does patient have: increased sputum purulence AND increased dyspnea OR increased sputum</p> <p>1. Initiate therapy with:</p> <ul style="list-style-type: none"> Short-acting bronchodilators (i.e. albuterol) increased to 6 to 8 puffs Q1-2H in severe exacerbations +/- Short-acting anticholinergics (i.e. ipratropium bromide) increased to 6 to 8 puffs Q3-4H in severe exacerbations given via nebulizer/inhaler PLUS Corticosteroids (prednisone or equivalent PO 40 mg/day for 5 days) if admitted OR have significant shortness of breath Methylprednisolone IV Q6-12H may be used initially <p>2. Consider obtaining sputum culture AND treat with an antimicrobial based on clinical severity</p> <ul style="list-style-type: none"> If patient has only an acute increase in <u>1</u> cardinal symptom no antibiotic therapy is recommended <p>3. Manage risk factors:</p> <ul style="list-style-type: none"> Assess if patient is due for influenza vaccine Smoking cessation counseling <p>4. Inpatient: If worsening clinical status OR inadequate response in 72H: re-evaluate AND obtain sputum culture AND gram stain</p>	Outpatient Uncomplicated	<p>Select <u>ONE</u> of the following:</p> <ul style="list-style-type: none"> Doxycycline 100 mg PO Q12H Amoxicillin 500 mg PO Q8H Azithromycin 500 mg once, then 250 mg PO Q24H SMX/TMP 1 DS tablet PO Q12H <p>Treat for 3 to 5 days</p>
	Outpatient Complicated* OR Failure of Previous Antimicrobial Therapy	<p>Primary Recommendation:</p> <ul style="list-style-type: none"> Amoxicillin/clavulanate 875 mg PO Q12H <p>Penicillin Allergy or Treatment Failure with Primary Regimen:</p> <ul style="list-style-type: none"> Moxifloxacin 400 mg PO Q24H** <p>Treat for 3 to 5 days</p>
	Inpatient	<p>Primary Recommendation:</p> <ul style="list-style-type: none"> Amoxicillin/clavulanate 875 mg PO Q12H <p><u>OR</u></p> <ul style="list-style-type: none"> Doxycycline 100 mg PO Q12H <p>Penicillin Allergy or Treatment Failure with Primary Regimen:</p> <ul style="list-style-type: none"> Moxifloxacin 400 mg PO Q24H** <p>Treat for 5 days</p>

DS= double strength; H= hour(s); IV= intravenous; PO= by mouth; Q= every; SMX/TMP= sulfamethoxazole/trimethoprim

*In patient with frequent exacerbations, (> 4 in previous 12 months) severe airflow limitation, and/or exacerbations requiring mechanical ventilation, FEV1 < 50%, and/or cardiovascular disease

** Previously failed therapy with azithromycin, doxycycline, and a beta- lactam **OR** received treatment with the aforementioned antibiotics within the previous 90 days **OR** patient has other comorbidities (i.e. chronic heart, liver, or renal disease, diabetes, alcoholism, malignancy, asplenia, immunocompromised or on immunosuppressing drugs. An FDA advisory committee determined that the risks of fluoroquinolone use in COPD exacerbation outweighed any potential benefit, and should not be a first-line agent.

NOTE: Dosing based on normal renal function. Refer to Table of Contents for section on Antimicrobial Dosing for Adult Patients Based on Renal Function

References:

- Vollenweider DJ, et al. Antibiotics for exacerbations of chronic obstructive pulmonary disease. *Cochrane Database Syst Rev.* 2012 Dec 12;12:CD010257.
- Vestbo J, et al. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease: GOLD executive summary. *Am J Respir Crit Care Med.* 2013 Feb 15;187(4):347-65.
- Food and Drug Administration. Joint meeting of the Antimicrobial Drugs Advisory Committee and the Drug Safety & Risk Management Advisory Committee (DSaRM)-Webcast Recording. 2015.

Respiratory Tract: Pneumonia

START HERE

Does the patient presenting with pneumonia have **any risk factors for multidrug resistant organisms (MDROs)**:

- Hospitalized for ≥ 2 days within previous 90 days
- Resides in a nursing home **OR** long-term care facility, **OR** skilled nursing facility

- Received recent antibiotic therapy (previous 90 days), chemotherapy, **OR** wound care within previous 30 days
- Chronic hemodialysis
- Have immunosuppressive disease **OR** receiving immunosuppressing medications

CLINICAL CONSIDERATIONS

- Infiltrate on chest x-ray required for pneumonia diagnosis
- Collect BAL **OR** PSB **AND** blood cultures prior to starting antimicrobial therapy
- Re-assess antibiotic therapy on day 2 or 3 when cultures return from microbiology lab
- Specific isolated pathogens should prompt clinicians to de-escalate treatment based on the pathogen's susceptibility pattern

NO RISK FACTORS FOR MDROS

INPATIENT NON-ICU

Ceftriaxone 1 gm IV Q24H
AND
 Azithromycin 500 mg PO/IV for 1 day, then 250 mg PO/IV Q24H for 4 days
OR
 Moxifloxacin 400 mg IV/PO Q24H

INPATIENT ICU

Ceftriaxone 2 gm IV Q24H
AND
 Moxifloxacin 400 mg IV Q24H
OR
 Ampicillin/sulbactam 3 gm IV Q6H
AND
 Moxifloxacin 400 mg IV Q24H
OR
Penicillin-allergic patients:
 Aztreonam 2 gm IV Q8–12H
AND
 Moxifloxacin 400 mg IV Q24H

RISK FACTORS FOR MDROS

INPATIENT

Beta-lactam/beta-lactamase inhibitor:
 Piperacillin-tazobactam 3.375 gm IV Q4H[†]
OR
 Piperacillin-tazobactam 4.5 gm IV Q6H
OR
 Antipseudomonal carbapenem:
 Imipenem 500 mg IV Q8H

PLUS

Aminoglycoside[‡] (Preferred)
 Gentamicin 5-6 mg/kg (IBW) once daily
 Tobramycin 5-6 mg/kg (IBW) once daily
OR
 Antipseudomonal fluoroquinolone:
 Levofloxacin 750 mg IV Q24H
 Ciprofloxacin 400 mg IV Q8H

PLUS

If at risk for MRSA:

Vancomycin 15 mg/kg IV[†]
OR
 Linezolid 600 mg IV/PO Q12H
(See Criteria for Use)

BAL= Bronchoalveolar Lavage; BP= blood pressure; bpm= beats or breaths per minute; CrCl= Creatinine Clearance; H= hour(s); IBW= ideal body weight; ICU= Intensive Care Unit; IV= intravenous; MDRO= multi-drug resistant organism; MRSA= Methicillin-Resistant *S. aureus*; PO= by mouth; PSB= Protected Specimen Brush; Q= every

[†]Suspect *P. aeruginosa*: CrCl >50 ml/min = 3.375 gm q4h; CrCl 50-10 ml/min = 3.375 gm IV Q6H; CrCl <10 ml/min = 3.375 gm Q8H

[‡]Refer to Table of Contents for section on vancomycin and aminoglycoside dosing and monitoring

Note: Dosing based on normal renal function. Refer to Table of Contents for section on Antimicrobial Dosing for Adult Patients Based on Renal Function.

Respiratory Tract: Pneumonia

NO RISK FACTORS FOR MDROs	RISK FACTORS FOR MDROs
<p>OUTPATIENT <u>Previously healthy AND no antibiotic use in previous 90 days:</u></p> <p>Doxycycline 100 mg PO Q12H for 5 days OR Azithromycin 500 mg PO for 1 dose, then 250 mg PO Q24H for 4 days</p>	<p>OUTPATIENT Treat accordingly based on risk factors and microbiologic history</p> <p>Consider paging Infectious Diseases</p>
<p>OUTPATIENT <u>Presence of ≥ 1 co-morbidities* OR antibiotic use in previous 30 days:</u></p> <p>Moxifloxacin 400 mg PO Q24H for 5 to 7 days OR Amoxicillin 1 gm PO Q8H for 5 to 7 days OR Amoxicillin/clavulanate 875 mg PO Q12H for 5 to 7 days AND Azithromycin 500 mg PO for 1 dose, then 250 mg PO Q24H for 4 days</p>	

THERAPY CONSIDERATIONS

- Cough and chest X-ray may take 4 to 6 weeks to improve/change
- Duration of therapy
 - Community-acquired pneumonia: 5–7 days
 - Healthcare-associated pneumonia, hospital-acquired pneumonia, ventilator-associated pneumonia: 7–8 days; provided that the targeted pathogen is identified based on bronchoscopy and the etiologic pathogen is not *P. aeruginosa*, and that the patient is: afebrile for 48 to 72 hours
AND ≤ 1 of the following:
 HR >100 bpm, RR >24 bpm, BP < 90 mmHg (systolic), O₂ sat <90%, altered mental status

BP= blood pressure; bpm= beats or breaths per minute; H= hour(s); HR= heart rate; IV= intravenous; MDRO= multi-drug resistant organism; PO= by mouth; Q= every; RR= respiratory rate

***Presence of comorbidities: chronic heart, lung, liver or renal disease; diabetes; alcoholism; malignancies; asplenia; immunosuppressing conditions or medications**

Note: Dosing based on normal renal function. Refer to Table of Contents for section on Antimicrobial Dosing for Adult Patients Based on Renal Function.

References:

- Mandell LA, Wunderink RG, Anzueto A, et al. Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. *Clin Infect Dis*. 2007 Mar 1;44 Suppl 2:S27-72
- American Thoracic Society; Infectious Diseases Society of America. Guidelines for the management of adults with hospital-acquired, ventilator-associated, and healthcare-associated pneumonia. *Am J Respir Crit Care Med*. 2005 Feb 15;171(4):388-416.

Sepsis

IV Antibiotics:

- If the patient is pregnant, contact pharmacy or Infectious Diseases for assistance regarding safety and dosage
- Penicillin allergic or optional antibiotic choices are listed second and italicized
- Antibiotics should be adjusted for weight and renal function in ALL patients
 - Consult pharmacy or Infectious Diseases if needed for assistance in monitoring therapeutic drug level
- Antibiotics should be ordered **AFTER** a review of previous microbiology data present in patient's electronic medical record
- Risk Factors for MRSA, VRE, and ESBL include:
 - Hospitalization within the past year
 - Patient receives hemodialysis
 - Oozing or open wound
 - Past history of documented MRSA, VRE, or ESBL
 - Patient is a nursing home resident
 - Patient has a catheter or line present

Administer antibiotics within FIRST HOUR of recognition of sepsis

SUSPECTED *Clostridium difficile* INFECTION

Vancomycin 500 mg PO/NGT x1 NOW **PLUS** Metronidazole 500 mg IV x1 NOW

SUSPECTED RESPIRATORY SOURCE	SUSPECTED URINARY SOURCE	SUSPECTED INTRA-ABDOMINAL SOURCE
Azithromycin 500 mg IV x1 NOW <u>PLUS</u> Ceftriaxone 2 gm IV x1 NOW <u>OR</u> Piperacillin/tazobactam 3.375 gm IV x1 NOW <u>OR</u> <u>If risk factors for MDR GNR or ESBL</u> Meropenem 2 gm x1 NOW <u>If risk factors for MRSA</u> Vancomycin 25-30 mg/kg ABW* IV LD x1 NOW	Piperacillin/tazobactam 3.375 gm IV x1 NOW <u>OR</u> <u>If risk factors for MDR GNR or ESBL</u> Meropenem 2 gm x1 NOW <u>If risk factors for MRSA</u> Vancomycin 25-30 mg/kg ABW* IV LD x1 NOW <u>If risk factors for VRE</u> Daptomycin 8-10mg/kg (ABW) x1 NOW & Consult ID	Piperacillin/tazobactam 3.375 gm IV x1 NOW <u>OR</u> <u>If risk factors for MDR GNR or ESBL</u> Meropenem 2 gm IV x1 NOW
If penicillin allergy, may consider consulting ID or substituting meropenem 2gm x1 NOW for other beta lactams (monitor; ≤5% cross-reactivity with penicillins).		

ABW= Actual Body Weight; ESBL= Extended Spectrum Beta-Lactamase; ID= Infectious Diseases; IV= intravenous; LD= loading dose; MDR GNR= Multi-Drug Resistant Gram-Negative Rods; MRSA= Methicillin-Resistant *S. aureus*; NGT= Nasogastric tube; PO= By Mouth; VRE= Vancomycin –Resistant Enterococcus

*Refer to Table of Contents for section on Vancomycin Dosing and Monitoring in Adult Patients

Symptomatic Sexually Transmitted Infection Screening

SYMPTOMATIC

	Symptoms	Recommended Diagnostic Testing	Clinical and Therapeutic Considerations
Female	<ul style="list-style-type: none"> Vaginal itching Vaginal discharge Painful urination Increased urinary urgency Pelvic pain Pain with sexual intercourse Vaginal bleeding Genital warts Genital lesion/ulcer Pharyngitis 	Vaginal examination: <ol style="list-style-type: none"> Observe vaginal anatomy Gram stain for bacterial vaginosis Vaginal swabs for PCR assay: <ul style="list-style-type: none"> Gonorrhea Chlamydia Vaginal swabs for Affirm DNA <ul style="list-style-type: none"> Trichomoniasis HIV test Syphilis (RPR screen/ titer) Urinalysis Pregnancy Test Oropharyngeal (OP) Culture swab for GC when indicated 	Promptly begin empiric treatment of Chlamydia and Gonorrhea before lab results return Vaginal exam will allow visualization of vaginal anatomy Vaginal or cervical swab may be necessary for specific test kits
		Unable to perform vaginal examination: <ol style="list-style-type: none"> Urinalysis Urine for PCR assay: <ul style="list-style-type: none"> Gonorrhea Chlamydia HIV test Syphilis (RPR screen/titer) Pregnancy Test OP Culture for GC when indicated 	Promptly begin empiric treatment of Chlamydia and Gonorrhea before lab results return
Male	<ul style="list-style-type: none"> Penile discharge Painful urination Increased urgency Pelvic pain Swollen/tender testicles Pain with sexual intercourse Genital warts Genital lesion/ulcer Pharyngitis 	<ol style="list-style-type: none"> Urinalysis Urine for PCR assay: <ul style="list-style-type: none"> Gonorrhea Chlamydia HIV test Syphilis (RPR screen/ titer) OP Culture Swab or Rectal culture swab for GC when indicated 	Promptly begin empiric treatment of Chlamydia and Gonorrhea before lab results return

TREATMENT (DISCUSS TREATMENT OF PREGNANT WOMEN WITH ID AND OB/GYN)

Gonorrhea Chlamydia	Ceftriaxone 250 mg IM AND Azithromycin 1 gm PO x 1 dose OR doxycycline 100 mg PO Q12H for 7 days <u>Penicillin Allergy (anaphylaxis):</u> Consult ID
HIV or Syphilis	Consult Infectious Diseases
Bacterial vaginosis	Metronidazole gel 0.75%, one full applicator (5gm) intravaginally once daily at bedtime for 5 days <u>Alternatives:</u> Metronidazole 500 mg PO Q12H OR clindamycin 300 mg PO Q12H for 7 days
Trichomonas vaginalis	Metronidazole 2 gm PO x 1 dose OR metronidazole 500 mg PO Q12H for 7 days

DNA= deoxyribonucleic acid; GC= gonococcus; H= hours; HIV= human immunodeficiency virus; ID= infectious diseases; IM= intramuscular; OB/GYN= obstetrics/gynecology; OP= Oropharyngeal; PCR= Polymerase chain reaction; PO= by mouth; Q= every; RPR= rapid plasma reagin; STI= sexually transmitted infection.

Asymptomatic Sexually Transmitted Infection Screening

ASYMPTOMATIC

	Population	Screening Recommendations	Frequency	Clinical and Therapeutic Considerations
Female	Age ≤ 25	Urine PCR for Chlamydia Urine PCR for Gonorrhea HIV test Cervical Screening	Annually Annually At least once No later than age 21	Cervical screening should be performed 3 years after initiating sexual activity or no later than age 21
	Age > 25	No routine screening for STIs Screen according to risk		Consider minimum of annual screening if high risk* patient
	Pregnant	Urine PCR for Chlamydia Urine PCR for Gonorrhea HIV test Hepatitis B S Ag, S Ab, C Ab Hepatitis C Ab Syphilis RPR/titer	First trimester First trimester First trimester First trimester First trimester First trimester	Repeat Screening (all pathogens) in 3 rd trimester and at birth if patient is high risk*
	HIV-positive	Urine PCR for Chlamydia Urine PCR for Gonorrhea* Syphilis RPR/titer Trichomoniasis Hepatitis B S Ag, S Ab, C Ab Hepatitis C Ab	Annually Annually Annually Annually Baseline Yearly if high risk*	*Consider rectal and pharyngeal culture swabs for GC if exposed May repeat screening every 3-6 months, as indicated by risk

EPT= expedited partner treatment; Hepatitis B C Ab= Hepatitis B Core Antibody; Hepatitis B S Ab= Hepatitis B Surface Antibody; Hepatitis B S Ag= Hepatitis B Surface Antigen; Hepatitis C Ab= Hepatitis C Antibody; HIV= human immunodeficiency virus; MSM= Men who have sex with men; PCR= polymerase chain reaction; RPR= rapid plasma reagin; STI= sexually transmitted infection

Test of Cure/ Retest Post Diagnosis and Treatment of Gonorrhea or Chlamydia

- Retest all patients after 3 months for reinfection (if 3 months not possible, within 1 year).
- Retest all pregnant patients a minimum of >=3 weeks after completion of therapy.
- If suspect treatment failure, reinfection , or failure due to alternative regimen then repeat testing at a minimum of >= 3weeks after completion of therapy.
- For pharyngeal gonorrhea– get test of cure on all patients after 14 days. Culture and susceptibilities preferred.

Note: Gonorrhea/Chlamydia PCR <3 weeks from completion of therapy are not recommended due to presence of non-viable organisms and false-positive results.

STIs: Partner Treatment

- Any recent sexual partner who has had contact with the infected patient within 60 days of their diagnosis should be considered for treatment.
- Discuss treatment of partners or questions regarding Expedited Partner Treatment (EPT) with the Infectious Disease Service.
- EPT should not be employed with MSMs (these patients should be referred for comprehensive STI testing first).

*Definition of High Risk

Those who have a new sex partner, >1 sex partner, a sex partner with concurrent partners, a sex partner who has a STI , inconsistent condom use in persons not in mutually monogamous relationships, illicit drug use, exchange of sex with drugs, recent sex contact outside the US.

Asymptomatic Sexually Transmitted Infection Screening

ASYMPTOMATIC

	Population	Screening Recommendations	Frequency	Clinical and Therapeutic Considerations
Male	Heterosexual men	No routine screening for STIs. Screen according to *risk. Note: All 'Babyboomers' (Patients born from 1945 through 1965) should be screened for HCV		
	Men who have sex with men (MSM) OR *high risk heterosexual men	Urine PCR for Chlamydia Urine PCR for Gonorrhea HIV test Hepatitis B S Ag, S Ab, C Ab Hepatitis C Ab Syphilis (RPR screen/ titer)	Annually Annually Annually Baseline Annually Annually	Consider GC/Chl culture, rectal and pharyngeal swabs High risk defined as: - New or multiple sex partners - Inconsistent condom use - Commercial sex work - Drug use May repeat screening every 3-6 months, as indicated by risk
	HIV-positive men	Urine PCR for Chlamydia Urine PCR for Gonorrhea Syphilis (RPR screen/ titer) Hepatitis B S Ag, S Ab, C Ab Hepatitis C Ab	Annually Annually Annually Baseline Annually	Consider GC/Chl culture, rectal and pharyngeal swabs May repeat screening every 3-6 months, as indicated by risk

GC/Chl= gonorrhea/chlamydia; HCV= Hepatitis C virus; Hepatitis B C Ab= Hepatitis B Core Antibody; Hepatitis B S Ab= Hepatitis B Surface Antibody; Hepatitis B S Ag= Hepatitis B Surface Antigen; Hepatitis C Ab= Hepatitis C Core Antibody; HIV= human immunodeficiency virus; MSM= Men who have sex with men; PCR= polymerase chain reaction; RPR= rapid plasma regain; STI = sexually transmitted infection.

*Definition of High Risk

Those who have a new sex partner, >1 sex partner, a sex partner with concurrent partners, a sex partner who has a STI, inconsistent condom use in persons not in mutually monogamous relationships, illicit drug use, exchange of sex with drugs, recent sex contact outside the US.

References:

1. "Sexually Transmitted Diseases Treatment Guidelines, 2015." Centers for Disease Control and Prevention. Department of Health and Human Services, 17 Dec. 2010. URL: <http://www.cdc.gov/std/treatment/2010/STD-Treatment-2010-RR5912.pdf>.
2. "Primary, Secondary, and Early Latent Syphilis Surveillance 2007-2011." Division of Infectious Disease & Epidemiology. Rhode Island Department of Health, 2011. URL: <http://www.health.ri.gov/data/diseases/Syphilis.pdf>.
3. "California Sexually Transmitted Disease (STD) Screening Recommendations 2010". California Department Of Public Health, June. 2011. URL: <http://www.cdph.ca.gov/pubsforms/Guidelines/Documents/CA-STD-Screening-Recommendations.pdf>

Asymptomatic Sexually Transmitted Infection Screening

HIV testing		
Population	Frequency	Special Considerations
All women age 13-64	Baseline	Consider frequent testing if high risk*
All women who seek STI screening	At time of STI	Consider PREP if HIV+ partner (Consult ID)
All pregnant women	First Trimester	Third trimester and at birth if high risk
All men age 13-64	Baseline	Consider frequent testing if high risk*
MSM	Annually (minimum)	Q3-6 months if higher risk activity (Consider PREP and consult ID)
All men who seek STI screening	At time of STI	Consider PREP if HIV+ partner (consult ID)

HIV= human immunodeficiency virus; ID= infectious diseases; MSM= Men who have sex with men; PREP= pre-exposure prophylaxis; Q= every; RPR= rapid plasma regain; STI= sexually transmitted infection.

*Definition of High Risk

Those who have a new sex partner, >1 sex partner, a sex partner with concurrent partners, a sex partner who has a STI, inconsistent condom use in persons not in mutually monogamous relationships, illicit drug use, exchange of sex with drugs, recent sex contact outside the US.

References:

1. "Sexually Transmitted Diseases Treatment Guidelines, 2015." Centers for Disease Control and Prevention. Department of Health and Human Services, 17 Dec. 2010. URL: <http://www.cdc.gov/std/treatment/2010/STD-Treatment-2010-RR5912.pdf>.
2. "Primary, Secondary, and Early Latent Syphilis Surveillance 2007-2011." Division of Infectious Disease & Epidemiology. Rhode Island Department of Health, 2011. URL: <http://www.health.ri.gov/data/diseases/Syphilis.pdf>.
3. "California Sexually Transmitted Disease (STD) Screening Recommendations 2010". California Department Of Public Health, June. 2011. URL: <http://www.cdph.ca.gov/pubsforms/Guidelines/Documents/CA-STD-Screening-Recommendations.pdf>

Skin and Soft Tissue Infections (SSTI)

NONPURULENT

Necrotizing Infection/Cellulitis/Erysipelas [Usually *Streptococcus pyogenes* (Group A Strep)]

Mild:
No systemic signs
of infection*

**Oral
Antibiotic Therapy**

Select ONE:

Penicillin VK
250-500 mg PO Q6H
Cephalexin
500 mg PO Q6H
Dicloxacillin
250 mg PO Q6H
Clindamycin
300-450 mg PO Q6H

Moderate:
Systemic signs of
infection*

**Intravenous
Antibiotic Therapy**

Select ONE:

Penicillin
2-4 million units IV
Q4-6H
Ceftriaxone
1 gm IV Q24H
Cefazolin
1 gm IV Q8H
Clindamycin
600-900 mg IV Q6H

Severe:
(any of the following):
Systemic signs of infection*,
failed antibiotic treatment,
immunocompromise,
hemodynamic instability, or
deep infection

Intravenous Antibiotic Therapy

Emergent Surgical Inspection/Debridement

- Rule out necrotizing process

Culture & Sensitivity Empiric Treatment

- Vancomycin 15 mg/kg IV** PLUS
- Piperacillin/tazobactam 3.375 gm IV Q6H +/-
- Clindamycin 900 mg IV Q8H***

Defined Treatment (Necrotizing Infections)

Monomicrobial

Streptococcus pyogenes

- Penicillin 2-4 million units IV Q4-6H PLUS Clindamycin 600-900 mg IV Q8H

Vibrio vulnificus

- Doxycycline 100 mg IV Q12H PLUS Ceftazidime 2 gm IV Q8H

Aeromonas hydrophila

- Doxycycline 100 mg IV Q12H PLUS Ciprofloxacin 400 mg IV Q12H

Polymicrobial

- Vancomycin 15 mg/kg IV** PLUS Piperacillin/tazobactam 3.375 gm IV Q4H

H= hours; IV= intravenous; PO= oral; Q= every

*Systemic signs of infection include, but are not limited to, temperature >38°C, tachycardia (heart rate >90 beats per minute), tachypnea (respiratory rate >24 breaths per minute) or abnormal white blood cell count (>12 000 or <4000 cells/μL).

**Refer to section on Vancomycin Dosing and Monitoring in Adult Patients.

***Consider this addition for necrotizing fasciitis.

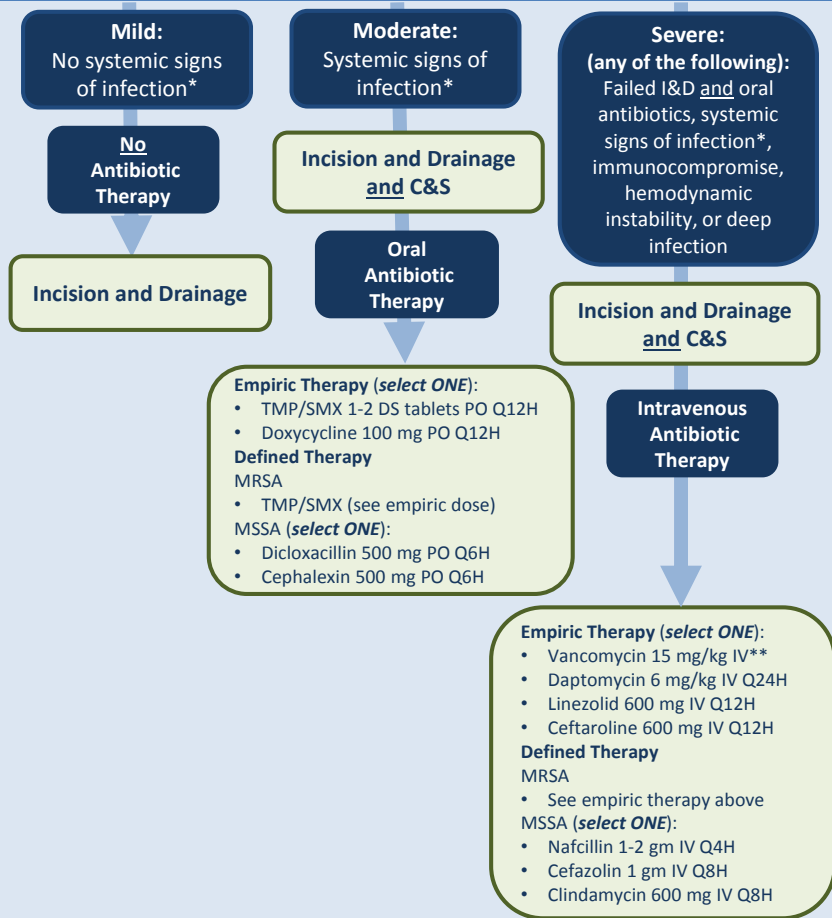
Note: Refer to Table of Contents for section on Antimicrobial Dosing for Adult Patients Based on Renal Function for dosing in patients with renal impairment.

References:

1. Stevens DL, Bisno AL, Chambers HF, Dellinger EP, Goldstein EJ, Gorbach SL, et al. Practice guidelines for the diagnosis and management of skin and soft tissue infections: 2014 update by the Infectious Diseases Society of America. *Clin Infect Dis*. 2014; 59(2): e10-52.
2. Duong M, Markwell S, Peter J, Barenkamp S. Randomized, controlled trial of antibiotics in the management of community-acquired skin abscesses in the pediatric patient. *Ann Emerg Med* 2010; 55:401-7.
3. Macfie J, Harvey J. The treatment of acute superficial abscesses: a prospective clinical trial. *Br J Surg* 1977; 64:264-6.
4. Ulera JL, Levy RC. Treatment of cutaneous abscess: a double-blind clinical study. *Ann Emerg Med* 1985; 14:15-9.
5. Rutherford WH, Hart D, Calderwood JW, Merrett JD. Antibiotics in surgical treatment of septic lesions. *Lancet* 1970; 1:1077-80.
6. Schmitz GR, Bruner D, Pitotti R, et al. Randomized controlled trial of trimethoprim-sulfamethoxazole for uncomplicated skin abscesses in patients at risk for community-associated methicillin-resistant *Staphylococcus aureus* infection. *Ann Emerg Med* 2010; 56:283-7.

Skin and Soft Tissue Infections (SSTI)

PURULENT Furuncle/Carbuncle/Abscess (Usually *Staphylococcus aureus*)



C&S= culture and sensitivity; DS= double-strength; H= Hours; I&D= incision and drainage; IV= intravenous; MRSA= methicillin-resistant *Staphylococcus aureus*; MSSA= methicillin-susceptible *Staphylococcus aureus*; PO= by mouth; Q= every; Rx= treatment; TMP/SMX= trimethoprim-sulfamethoxazole

*Systemic signs of infection, but are not limited to, include temperature >38°C, tachycardia (heart rate >90 beats per minute), tachypnea (respiratory rate >24 breaths per minute) or abnormal white blood cell count (>12 000 or <4000 cells/μL).

**Refer to section on Vancomycin Dosing and Monitoring in Adult Patients.

References:

1. Stevens DL, Bisno AL, Chambers HF, et al. Practice guidelines for the diagnosis and management of skin and soft tissue infections: 2014 update by the Infectious Diseases Society of America. *Clin Infect Dis*. 2014; 59(2): e10-52.
2. Duong M, Markwell S, Peter J, Barenkamp S. Randomized, controlled trial of antibiotics in the management of community-acquired skin abscesses in the pediatric patient. *Ann Emerg Med* 2010; 55:401-7.
3. Macfie J, Harvey J. The treatment of acute superficial abscesses: a prospective clinical trial. *Br J Surg* 1977; 64:264-6.
4. Uiera JL, Levy RC. Treatment of cutaneous abscess: a double-blind clinical study. *Ann Emerg Med* 1985; 14:15-9.
5. Rutherford WH, Hart D, Calderwood JW, Merrett JD. Antibiotics in surgical treatment of septic lesions. *Lancet* 1970; 1:1077-80.
6. Schmitz GR, Bruner D, Pitotti R, et al. Randomized controlled trial of trimethoprim-sulfamethoxazole for uncomplicated skin abscesses in patients at risk for community-associated methicillin-resistant *Staphylococcus aureus* infection. *Ann Emerg Med* 2010; 56:283-7.

Skin and Soft Tissue: Diabetic Foot Infections

SEVERITY OF INFECTION	SUSPECTED ORGANISMS	RECOMMENDED EMPIRICAL TREATMENT	DURATION
Mild <ul style="list-style-type: none"> Only skin and subcutaneous tissue involvement AND <ul style="list-style-type: none"> Erythema > 0.5 cm and ≤ 2 cm around ulcer Perform incision and drainage as necessary 	MSSA <i>Streptococcus spp.</i>	Oral Amoxicillin/clavulanate 875 mg PO Q12H OR Cephalexin 500 mg PO Q6H OR Dicloxacillin 250 – 500 mg PO Q6H	1–2 weeks
	MRSA	Doxycycline 100 mg PO Q12H OR SMX/TMP 2 DS tablets PO Q12H <i>(Does not cover Group A Strep)</i>	
Moderate** <ul style="list-style-type: none"> Deeper tissue involvement OR <ul style="list-style-type: none"> Erythema > 2.0 cm around ulcer AND <ul style="list-style-type: none"> No systemic signs of infection Perform incision and drainage as necessary 	MSSA <i>Streptococcus spp.</i> Enterobacteriaceae Obligate anaerobes	Oral OR Initially Parenteral Ampicillin-sulbactam 1.5–3 gm IV Q6H OR Ceftriaxone 1 gm IV Q24H Penicillin Allergy: Ciprofloxacin 500 mg PO Q12H AND Clindamycin 300 mg PO Q6H OR Ceftriaxone 1 gm IV Q24H	1–3 weeks
	MRSA	Linezolid 600 mg IV/PO Q12H [†] <i>(Requires ID Consult)</i> OR Daptomycin 6 mg/kg IV Q24H [†] <i>(Requires ID Consult)</i> OR Vancomycin 15 mg/kg IV*	
	<i>Pseudomonas aeruginosa</i>	Piperacillin-tazobactam 3.375 gm IV Q4H	

DS= Double Strength; H= hour(s); IV= intravenous; MRSA= methicillin resistant *S. aureus*; MSSA= methicillin sensitive *S. aureus*; PO= by mouth; Q= every; SMX-TMP= sulfamethoxazole/trimethoprim; spp= species

[†] Restricted Antibiotic – refer to Table of Contents for Guidelines for Restricted Antimicrobials

* Refer to Table of Contents for section on Vancomycin Dosing and Monitoring in Adult Patients

** Consult Infectious Diseases and Podiatry

NOTE: Dosing based on normal renal function. Refer to Table of Contents for section on Antimicrobial Dosing for Adult Patients Based on Renal Function

Skin and Soft Tissue: Diabetic Foot Infections

SEVERITY OF INFECTION	SUSPECTED ORGANISMS	RECOMMENDED EMPIRICAL TREATMENT	DURATION
Severe** <ul style="list-style-type: none"> Same as moderate AND <ul style="list-style-type: none"> Systemic signs of infection present Systemic Inflammatory Response Syndrome (SIRS) Criteria ≥2 of the following: <ul style="list-style-type: none"> Temperature <96.8°F OR >100.4°F P > 90 BPM RR > 20 BPM PaCO₂ < 32 mmHg WBC < 4000 cells/mm³ OR >12,000 cells/mm³ ≥ 10% immature (band) forms Perform incision and drainage as necessary 	MSSA/MRSA <i>P. aeruginosa</i> <i>Streptococcus spp.</i> Enterobacteriaceae Obligate anaerobes	Initially Parenteral Vancomycin 15 mg/kg IV* AND** Cefepime 2 gm IV Q8H + metronidazole 500 mg IV Q6H OR Piperacillin-tazobactam 3.375 gm IV Q4H	2–4 weeks
		Bone OR Joint Involvement† Source removed: 2-5 days Source removed but residual tissue infection: 1-3 weeks Source removed but residual bone infection: 4-6 weeks Source not removed: ≥3 months	

BPM= beats or breaths per minute; H= hour(s); IV= intravenous; MRSA= methicillin resistant *S. aureus*; MSSA= methicillin sensitive *S. aureus*; P= pulse; PaCO₂= partial pressure of carbon dioxide; Q= every; RR= respiratory rate; SIRS= Systemic Inflammatory Response Syndrome; spp= species; WBC= white blood cell

† Restricted Antibiotic – refer to Table of Contents for Guidelines for Restricted Antimicrobials

* Refer to Table of Contents for section on Vancomycin Dosing and Monitoring in Adult Patients

** Consult Infectious Diseases and Podiatry

‡ Discuss plan with Infectious Diseases, Podiatry, and Vascular

NOTE: Dosing based on normal renal function. Refer to Table of Contents for section on Antimicrobial Dosing for Adult Patients Based on Renal Function

References:

- Lipsky BA, Berendt AR, Cornia PB, Pile JC, Peters EJ, et al. Clinical Practice Guidelines by the Infectious Diseases Society of America for the Diagnosis and Treatment of Diabetic Foot Infections. *Clin Infect Dis* 2012;54(12):e132-73.
- Flagyl [package insert]. New York, NY: Pfizer; 2015.

Surgical Decolonization and Prophylaxis

DECOLONIZATION

Nasal Screening Result	Recommended Intervention
MRSA Negative MSSA Negative	<ul style="list-style-type: none"> No decolonization required
MSSA Positive	<ul style="list-style-type: none"> Intranasal mupirocin twice daily x 5 days
MRSA Positive	<ul style="list-style-type: none"> Intranasal mupirocin twice daily x 5 days, AND Chlorhexidine bathing one day prior to surgery

ANTIMICROBIAL PROPHYLAXIS

CLINICAL CONSIDERATIONS

- Preoperative dose-timing
Within 60 minutes of surgical incision
Exceptions: vancomycin and fluoroquinolones within 120 minutes of surgical incision
- Weight-based dosing
Cefazolin: 2 gm for patients <120 kg, and 3 gm for patients ≥120 kg
Vancomycin: use ABW
Gentamicin: use ABW unless ABW is >120% of their IBW, in which case use AdjBW (see below for equation)
- Duration of prophylaxis
A single dose, or continuation for <24 hours is recommended

INTRA-OPERATIVE REDOSING

- Required if the duration of procedure exceeds two half-lives of the drug or if there is extensive blood loss during the procedure (>1500 mL) [†]
- Recommendation: use the same antibiotic dose and measure the redosing interval from the time of administration of the preoperative dose, not the time of incision

ABW= actual body weight; AdjBW= adjusted body weight; IBW= ideal body weight; MRSA= Methicillin-resistant Staphylococcus aureus; MSSA= Methicillin-susceptible Staphylococcus aureus

[†] Redosing may not be necessary for patients with poor renal function (CrCl <30mL/min)

IBW Calculation:

Male = 50 kg + [2.3 kg for each inch over 5 feet]
Female = 45 kg + [2.3 kg for each inch over 5 feet]

AdjBW Calculation:

AdjBW = 0.4 (ABW-IBW) + IBW

References:

- Schweizer ML, Chiang H, Septimus E, Moody J, Braun B, Hafner J, et al. Association of a Bundled Intervention with Surgical Site Infections Among Patients Undergoing Cardiac, Hip, or Knee Surgery (STOP SSI – Study to Optimally Prevent SSI in Select Cardiac and Orthopedic Procedures). *JAMA* 2015; 313(21): 2162-2171.
- Chen AF, Wessel CB, Rao N. Staphylococcus aureus Screening and Decolonization in Orthopaedic Surgery and Reduction of Surgical Site Infections. *Clin Orthop Relat Res* 2013; 471: 2383-2399.
- Bratzler DW, Dellinger EP, Olsen KM, Perl TM, Auwaerter PG, Bolon MK, et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. *Am J Health Syst Pharm* 2013; 70:195-283.

Antimicrobial Surgical Prophylaxis

REDOSING RECOMMENDATIONS

Antibiotic	Half-life (hours)	Redosing Interval (hours)
Ampicillin/sulbactam	0.8-1.3	2
Cefazolin	1.2-2.2	4
Cefoxitin	0.7-1.1	2
Ciprofloxacin	3-7	Not necessary
Clindamycin	2-4	6
Gentamicin	2-3	Not necessary
Metronidazole	6-8	Not necessary
Vancomycin	4-8	Not necessary
SURGICAL PROCEDURE	RECOMMENDED AGENTS	ALTERNATIVES FOR PATIENTS WITH BETA-LACTAM ALLERGY
Laparoscopic, low-risk	None	None
Laparoscopic, high-risk	Cefazolin, cefoxitin, cefotetan, ceftriaxone, ampicillin/sulbactam	Clindamycin or vancomycin + aminoglycoside or aztreonam or fluoroquinolone
Small intestine, nonobstructed	Cefazolin	Clindamycin + aminoglycoside or aztreonam or fluoroquinolone
Small intestine, obstructed	Cefazolin + metronidazole, cefoxitin, cefotetan	Metronidazole + aminoglycoside or fluoroquinolone
Hernia repair	Cefazolin	Clindamycin, vancomycin
Colorectal	Cefazolin + metronidazole, cefoxitin, cefotetan, ampicillin/sulbactam, ceftriaxone + metronidazole, ertapenem	Clindamycin + aminoglycoside or aztreonam or fluoroquinolone; Metronidazole + aminoglycoside or fluoroquinolone
Head and neck, clean	None	None
Head and neck, placement of prosthetic	Cefazolin, cefuroxime	Clindamycin
Clean-contaminated cancer surgery	Cefazolin + metronidazole, cefuroxime + metronidazole, ampicillin/sulbactam	Clindamycin

References:

1. Bratzler DW, Dellinger EP, Olsen KM, Perl TM, Auwaerter PG, Bolon MK, et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. *Am J Health Syst Pharm* 2013; 70:195-283.

Antimicrobial Surgical Prophylaxis

SURGICAL PROCEDURE	RECOMMENDED AGENTS	ALTERNATIVES FOR PATIENTS WITH BETA-LACTAM ALLERGY
Ortho: clean hand, knee, or foot not involving implantation of foreign materials	None	None
Ortho: implantation of foreign material and/or total joints	Cefazolin	Clindamycin, vancomycin
Urologic with risk factors for infection	Fluoroquinolone, TMP/SMX, cefazolin	Aminoglycoside +/- clindamycin
Urologic, clean without entry into urinary tract	Cefazolin*	Clindamycin, vancomycin
Urologic involving implanted prosthesis	Cefazolin ± aminoglycoside, cefazolin ± aztreonam, ampicillin/sulbactam	Clindamycin ± aminoglycoside or aztreonam, vancomycin ± aminoglycoside or aztreonam
Urologic, clean with entry into urinary tract	Cefazolin*	Fluoroquinolone, aminoglycoside ± clindamycin
Urologic, clean-contaminated	Cefazolin + metronidazole, cefoxitin	Fluoroquinolone, aminoglycoside + metronidazole or clindamycin

TMP/SMX= trimethoprim/sulfamethoxazole

*Addition of a single dose of an aminoglycoside may be recommended for placement of prosthetic material (e.g. penile prosthesis)

References:

1. Bratzler DW, Dellinger EP, Olsen KM, Perl TM, Auwaerter PG, Bolon MK, et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. *Am J Health Syst Pharm* 2013; 70:195-283.

Urinary Tract: Catheter-Associated Urinary Tract Infection

CLASSIFICATION	CLINICAL FINDINGS	RECOMMENDED EMPIRIC REGIMENS	CLINICAL CONSIDERATIONS
Asymptomatic Bacteriuria	<ul style="list-style-type: none"> Positive urine culture ($\geq 100,000$ cfu/mL of ≥ 1 bacterial species in a single catheter urine specimen) <p>AND</p> <ul style="list-style-type: none"> No sign or symptoms 	<p>Remove catheter</p> <p>No antibiotics unless the patient is:</p> <ul style="list-style-type: none"> Scheduled for urologic procedure Pregnant <p><u>Scheduled Urologic Procedure:</u> SMX/TMP 1 DS tablet PO Q12H OR Ciprofloxacin 500 mg PO OR Ciprofloxacin 400 mg IV Q12H</p> <p>Initiate within 24 hours prior to procedure and until foley removed</p> <p><u>Pregnant:</u> Amoxicillin 500 mg PO Q12H for 3 to 7 days OR Cephalexin 500 mg PO Q12H for 3 to 7 days OR Nitrofurantoin (MacroBID)* 100 mg PO Q12H for 5 days</p>	<ul style="list-style-type: none"> Obtaining routine cultures in asymptomatic patients is <u>NOT</u> recommended In the presence of a catheter, pyuria ($>5-10$ WBC) in an asymptomatic patient is <u>NOT</u> an indication for antibiotic treatment Presence or absence of odorous or cloudy urine alone is <u>NOT</u> an indication for antibiotic treatment Antibiotics do <u>NOT</u> decrease asymptomatic bacteriuria or prevent subsequent UTI
Symptomatic <u>AND</u> ≥ 1 of the following: <ul style="list-style-type: none"> Male Pyelonephritis Antibiotic use in previous 90 days History of infection with MDRO Immuno-compromised Functional or anatomic urologic abnormality Severe sepsis 	<ul style="list-style-type: none"> Positive urine culture ($\geq 1,000$ cfu/mL of ≥ 1 bacterial species in a single catheter urine specimen) <p>AND</p> <ul style="list-style-type: none"> Presence of signs/symptoms <p>Catheter still in place:</p> <ul style="list-style-type: none"> Malaise/lethargy Fever ($\geq 100.4^{\circ}\text{F}$)/rigors Altered mental status Flank pain Pelvic discomfort Acute hematuria <p>Catheter removed within past 48 h:</p> <ul style="list-style-type: none"> Dysuria Urgency Frequency Suprapubic pain/tenderness 	<p><u>Outpatient:</u> SMX/TMP DS tablet PO Q12H OR Nitrofurantoin (MacroBID)* 100 mg PO Q12H OR Ciprofloxacin 250 - 500 mg PO Q12H</p> <p><u>Inpatient:</u> Cefazolin 2 gm IV Q8H OR Cefepime 1 gm IV Q12H OR Ampicillin/sulbactam 1.5 gm IV Q6H</p> <p><u>Known or suspected ESBL bacteria:</u> Meropenem 1 gm IV Q8H OR Ertapenem 1 gm IV Q24H</p> <p>Duration of Treatment: Prompt resolution: 7 days Delay response: 10-14 days</p>	<ul style="list-style-type: none"> Remove catheter whenever possible Narrow antibiotic therapy when organism and susceptibilities are known Follow-up urine cultures or urinalysis are only warranted for ongoing symptoms. They should <u>NOT</u> be obtained routinely to monitor response to therapy

cfu= colony forming units; DS= double strength; ESBL= extended spectrum beta-lactamase; H= hour(s); IV= intravenous; MDRO= multi-drug resistant organism; PO= by mouth; Q= every; SMX/TMP= sulfamethoxazole/trimethoprim; UTI= Urinary Tract Infection; WBC= white blood cell

*Nitrofurantoin: Contraindicated if CrCl < 60 mL/min AND only indicated in acute cystitis

Urinary Tract: Non-Catheter-Associated Urinary Tract Infection / Cystitis

CLASSIFICATION	CLINICAL FINDINGS	RECOMMENDED EMPIRIC REGIMENS	CLINICAL CONSIDERATIONS
Asymptomatic Bacteriuria	<ul style="list-style-type: none"> Pyuria (urinalysis > 5- 10 WBC) <p>OR</p> <ul style="list-style-type: none"> Positive urine culture ($\geq 100,000$ cfu/mL)[†] <p>AND</p> <ul style="list-style-type: none"> No sign or symptoms (see below) 	<p>No antibiotics unless the patient is:</p> <ul style="list-style-type: none"> Scheduled for urologic procedure Pregnant <p>Scheduled Urologic Procedure: SMX/TMP 1 DS tablet PO Q12H</p> <p>OR Ciprofloxacin 500 mg PO</p> <p>OR Ciprofloxacin 400 mg IV Q12H</p> <p>Initiate within 24 hours prior to procedure and until foley removed</p> <p>Pregnant: Amoxicillin 500 mg PO Q12H for 3 to 7 days</p> <p>OR Cephalexin 500 mg PO Q12H for 3 to 7 days</p> <p>OR Nitrofurantoin (MacroBID)[‡] 100 mg PO Q12H for 5 days</p>	<ul style="list-style-type: none"> Obtaining routine cultures in asymptomatic patients is <u>NOT</u> recommended Antibiotics do <u>NOT</u> decrease asymptomatic bacteriuria or prevent subsequent UTI
Symptomatic: Complicated ≥ 1 of the following: <ul style="list-style-type: none"> Male Pyelonephritis Antibiotic use in previous 90 days History of infection with MDRO Immuno-compromised Functional or anatomic urologic abnormality Severe sepsis 	<ul style="list-style-type: none"> Pyuria (Urinalysis ≥ 5 WBC) <p>AND</p> <ul style="list-style-type: none"> Positive urine culture ($\geq 100,000$ cfu/mL)[†] <p>AND</p> <ul style="list-style-type: none"> Presence of symptoms: <ul style="list-style-type: none"> Dysuria Urgency Frequency Suprapubic pain <p>AND/OR</p> <ul style="list-style-type: none"> Presence of signs: <ul style="list-style-type: none"> Fever ($\geq 100.4^{\circ}\text{F}$) Altered mental status Leukocytosis 	<p>Outpatient: SMX/TMP 1 DS tablet PO Q12H</p> <p>OR Nitrofurantoin (MacroBID)[‡] 100 mg PO Q12H</p> <p>OR Ciprofloxacin 250 - 500 mg PO Q12H</p> <p>Inpatient: Cefazolin 2 gm IV Q8H</p> <p>OR Cefepime 1 gm IV Q12H</p> <p>OR Ampicillin/sulbactam 1.5 gm IV Q6H</p> <p>Known or suspected ESBL bacteria: Meropenem 1 gm IV Q8H</p> <p>OR Ertapenem 1 gm IV Q24H</p> <p>Duration of Treatment: 7 to 14 days</p>	<ul style="list-style-type: none"> Narrow antibiotic therapy when organism and susceptibilities are known Follow-up urine cultures or urinalysis are only warranted for on-going symptoms. They should <u>NOT</u> be obtained routinely to monitor response to therapy

cfu= colony forming units; ESBL= extended spectrum beta-lactamase; H= hour(s); IV= intravenous; MDRO= multi-drug resistant organism; PO= by mouth; Q= every; SMX/TMP= sulfamethoxazole/trimethoprim; UTI= Urinary Tract Infection; WBC= white blood cell count

[†]Positive urine culture:

For Women: 2 consecutive voided urine specimens with isolation of $>10^5$ cfu/mL of the same bacterial strain

For Men: A single, clean-catch, voided urine specimen with isolation of $>10^5$ cfu/mL from 1 bacterial species

[‡]Nitrofurantoin: Contraindicated if CrCl < 60 mL/min **AND** only indicated in acute cystitis

Urinary Tract: Non-Catheter-Associated Urinary Tract Infection / Cystitis

CLASSIFICATION	CLINICAL FINDINGS	RECOMMENDED EMPIRIC REGIMENS	CLINICAL CONSIDERATIONS
Symptomatic Uncomplicated/ Cystitis <ul style="list-style-type: none"> Female AND <ul style="list-style-type: none"> No criteria for complicated (see previous page) 	<ul style="list-style-type: none"> Pyuria (Urinalysis: ≥ 5 WBC) AND <ul style="list-style-type: none"> Positive urine culture ($\geq 100,000$ cfu/mL)[†] AND <ul style="list-style-type: none"> Presence of symptoms: <ul style="list-style-type: none"> Dysuria Urgency Frequency Suprapubic pain 	Nitrofurantoin (MacroBID) [‡] 100 mg PO Q12H for 5 days OR SMX/TMP 1 DS tablet PO Q12H for 3 days <i>Alternative agents should be avoided if possible due to the risk of C. difficile AND antibiotic resistance. IF patient has an allergy/contraindication to the above antibiotics alternatives include: Ciprofloxacin 250 mg PO Q12H for 3 days OR Cephalexin 500 mg PO Q12H for 3 days</i>	<ul style="list-style-type: none"> Urine culture should be performed ONLY IF: <ul style="list-style-type: none"> History of multiple UTIs OR MDRO infection(s) Narrow antibiotic therapy when organism and susceptibilities are known Follow-up urine cultures or UA are only warranted for on-going symptoms. They should NOT be obtained routinely to monitor response to therapy

Urinary Tract: Prostatitis

CLASSIFICATION	PREFERRED REGIMEN	ALTERNATIVE REGIMENS	CLINICAL CONSIDERATIONS
Outpatient	Ciprofloxacin 500 mg PO Q12H	SMX/TMP 1 DS tablet PO Q12H OR Levofloxacin 500 mg PO once daily (Requires ID Consult) Duration of Treatment: 28 days	Beta-lactams DO NOT have adequate penetration into prostate

cfu= colony forming units; DS= double strength; H= hour(s); MDRO= multi-drug resistant organism; PO= by mouth; Q= every; SMX/TMP= sulfamethoxazole/trimethoprim; UA= urinalysis; UTI= Urinary Tract Infection; WBC= white blood cell count

[†]Positive urine culture:

For Women: 2 consecutive voided urine specimens with isolation of $>10^5$ cfu/mL of the same bacterial strain

For Men: A single, clean-catch, voided urine specimen with isolation of $>10^5$ cfu/mL from 1 bacterial species

[‡]Nitrofurantoin: Contraindicated if CrCl < 60 mL/min **AND** only indicated in acute cystitis

NOTE: Dosing based on normal renal function. Refer to Table of Contents for section on Antimicrobial Dosing for Adult Patients Based on Renal Function

References:

- Hooton TM, Bradley SF, Cardena DD, et al. Diagnosis, prevention, and treatment of catheter-associated urinary tract infection in adults: 2009 international clinical practice guidelines from the Infectious Disease Society of America. *CID* 2010;50:625-63.
- Nicolle LE, et al. Infectious Diseases Society of America guidelines for the diagnosis and treatment of asymptomatic bacteriuria in adults. *Clin Infect Dis*. 2005 Mar 1;40(5):643-54.
- Gupta K, et al. International clinical practice guidelines for the treatment of acute uncomplicated cystitis and pyelonephritis in women: A 2010 update by the Infectious Diseases Society of America and European Society for Microbiology and Infectious Diseases. *Clin Infect Dis*. 2011 Mar 1;52(5):e103-20.

Pneumococcal Vaccine



Pneumococcal Vaccination Recommendations Adults ≥19 Years¹⁻⁴

(Including updated recommendations for the use of PCV13 in Adults)

THE
UNIVERSITY
OF RHODE ISLAND
COLLEGE OF
PHARMACY

Healthy Adults ≥ 65

Pneumococcal Vaccination
Naïve or Unknown History

GIVE: PCV13

Wait ≥ 1 year*

GIVE: PPSV23†

Previously vaccinated with
PPSV23 at age ≥65

≥ 1 year after PPSV23

GIVE: PCV13 if not previously given

Previously vaccinated with
PPSV23 before age 65

≥ 1 year after PPSV23

GIVE: PCV13 if not previously given

Wait ≥ 1 year*
(and ≥ 5 years after PPSV23)

GIVE: PPSV23†

ADULTS ≥ 19 with UNDERLYING MEDICAL CONDITIONS (see chart on back) OR who SMOKE or live in a NURSING HOME

Pneumococcal Vaccination
Naïve or Unknown History

GIVE: PPSV23

At Age ≥65

GIVE: PCV13 ≥ 1 year after PPSV23
THEN: PPSV23† ≥ 1 year* after
PCV13 and ≥ 5 years after PPSV23

Previously vaccinated with one
dose **PPSV23**

At Age ≥65

GIVE: PCV13 ≥ 1 year after PPSV23
THEN: PPSV23† ≥ 1 year* after
PCV13 and ≥ 5 years after PPSV23

Vaccination is **NOT**
indicated for healthy persons
19 - 64 years of age

While PCV13 is FDA-approved for
persons > 50 years, the Advisory
Committee on Immune Practices
does not provide guidance for use
in this population.

ADULTS ≥ 19 with IMMUNE COMPROMISING CONDITIONS (see chart on back), OR ASPLENIA (including sickle cell anemia), CEREBROSPINAL FLUID LEAK, or COCHLEAR IMPLANT

Pneumococcal Vaccination
Naïve or Unknown History

GIVE: PCV13

≥ 8 weeks* later

If < 65
GIVE: PPSV23

If < 65 and
≥ 5 years after
PPSV23
GIVE: second
PPSV23‡

At Age ≥65
GIVE: PPSV23†
≥ 5 years after
PPSV23

GIVE: PPSV23†

Previously vaccinated with one
dose **PPSV23**

≥ 1 year after PPSV23

GIVE: PCV13 if not previously given

≥ 8 weeks* later

If < 65 and
≥ 5 years after
PPSV23
GIVE: second
PPSV23‡

At Age ≥65
GIVE: PPSV23†
≥ 5 years after
PPSV23

If ≥ 65

GIVE: PPSV23†
≥ 5 years after
PPSV23

Previously vaccinated with
two doses of **PPSV23**

≥ 1 year after PPSV23

GIVE: PCV13 if not previously given

At Age ≥ 65
GIVE: PPSV23† ≥ 8 weeks* after
PCV13 and ≥ 5 years after PPSV23

* Minimum interval between sequential administration of PCV13 and PPSV23 is 8 weeks in immunocompromised patients.

† For Medicare reimbursement interval must be 11 full months. Please refer to page 4.

‡ The ACIP (Advisory Committee on Immunization Practices) recommends only 1 dose of PPSV23 at age ≥65. Revaccination is not necessary.

§ A second PPSV23 for patients with cerebrospinal fluid leak, or cochlear implant is not required.

PPSV23—23-Valent Pneumococcal Polysaccharide Vaccine (Pneumovax®23)

PCV13—13-Valent Pneumococcal Conjugate Vaccine (Prevnar 13®)

Pneumococcal Vaccine



Pneumococcal Vaccination Recommendations

Adults ≥19 Years¹⁻⁵

(Including updated recommendations for the use of PCV13 in Adults)

THE
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PHARMACY

PCV13 and PPSV23 Indications for Adults ≥ 19 Years* by Risk Group^{2,3}

Risk Group	Underlying Medical Condition	PCV13 (Prennar13®)	PPSV23 (Pneumovax®23)	
		Recommended	Recommended	Revaccinate 5 years after first dose
Persons with normal immune function	Cigarette smoker		✓	
	Chronic heart disease†		✓	
	Chronic lung disease‡		✓	
	Diabetes mellitus		✓	
	Cerebrospinal fluid leak	✓	✓	
	Cochlear implant‡	✓	✓	
	Alcoholism		✓	
	Chronic liver disease, cirrhosis		✓	
Persons with functional or anatomical asplenia (Please refer to reference 3 for specific guidance.)	Sickle cell disease or other hemoglobinopathy™	✓	✓	✓
	Congenital or acquired asplenia™	✓	✓	✓
Immunocompromised persons (Please refer to reference 3 for specific guidance.)	Congenital or acquired immunodeficiency¶	✓	✓	✓
	HIV infection	✓	✓	✓
	Chronic renal failure	✓	✓	✓
	Nephrotic syndrome	✓	✓	✓
	Leukemia	✓	✓	✓
	Lymphoma	✓	✓	✓
	Hodgkin disease	✓	✓	✓
	Generalized malignancy	✓	✓	✓
	Iatrogenic immunosuppression** (Both high and low level immunosuppression)	✓	✓	✓
	Solid organ transplant	✓	✓	✓
	Multiple myeloma	✓	✓	✓
	Hematopoietic stem cell transplant	Please refer to reference 3 for specific guidance		

† Including congestive heart failure and cardiomyopathies, excluding hypertension.

‡ If feasible, administer PCV13 and PPSV23 ≥ 2 weeks before planned cochlear implant surgery at appropriate intervals as described in the algorithm on the front page.

™ For PPSV23 naive patients planning splenectomy: Give PCV13; wait at least 8 weeks then give PPSV23. Do not give PPSV23 within 2 weeks of planned splenectomy.

§ Including chronic obstructive pulmonary disease, emphysema, and asthma.

¶ Includes B- (humoral) or T-lymphocyte deficiency, complement deficiencies (particularly C1, C2, C3, and C4 deficiencies), and phagocytic disorders (excluding chronic granulomatous disease).

** Those requiring treatment with immunosuppressive drugs, including long-term systemic corticosteroids and radiation.

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2. CDC. Use of 13-valent pneumococcal conjugate vaccine and 23-valent pneumococcal polysaccharide vaccine for adults with immunocompromising conditions: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Morb Mortal Wkly Rep. 2012;61(40):816-819.
3. CDC. Use of 13-valent pneumococcal conjugate vaccine and 23-valent pneumococcal polysaccharide vaccine among adults aged ≥ 19 years: Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Morb Mortal Wkly Rep. 2014;63(37):822-825.
4. Kobayashi M, Bennett NM, Gierke R, et al. Intervals between PCV13 and PPSV23 vaccines: Recommendations of the Advisory Committee on Immunization Practice (ACIP). MMWR Morb Mortal Wkly Rep. 2015; 64(34): 944-947.
5. Rubin LG, Levin MJ, Davies EG, et al. 2013 IDSA clinical practice guideline for vaccination of the immunocompromised host. Clin Infect Dis. 2014;58:e44-e100. doi: 10.1093/cid/cit884.

Pneumococcal Vaccine

Pneumococcal Vaccination Information Sheet

PCV13 (Pneumovax 13®) and PPSV23 (Pneumovax® 23)

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Facts About Pneumococcal Disease:

- *Streptococcus pneumoniae* bacteria (i.e., pneumococci) are usually found in the upper respiratory tract of most people.
- Pneumococcal disease most commonly presents as a serious infection in the lungs (pneumonia), blood (bacteremia), or brain (meningitis). The annual U.S. case estimate for invasive pneumococcal disease (bacteremia and/or meningitis) is 40,000 and 4,250 deaths.
- Pneumococcal disease most often occurs in older people as well as in people with a predisposing condition (e.g., immunosuppression, pulmonary disease, heart disease, diabetes). The disease rates for adults in these groups can be more than 20 times those for adults without high-risk medical conditions.
- PPSV23 is 60–70% effective in preventing serious pneumococcal disease; it does not provide substantial protection against all types of pneumonia (viral and bacterial). It is not a “pneumonia” vaccine.

Frequently Asked Questions:

Question: Can I get the influenza and pneumococcal vaccines at the same time?

Yes. These vaccines can be given at the same time. If giving two IM vaccinations, separate by one inch in the body muscle to reduce likelihood of local reactions overlapping.

Question: If patients who are in a recommended risk group for PPSV23 or PCV13 aren't sure if they have previously received these vaccines, should healthcare providers vaccinate them?

Yes. If patients do not have a documented vaccination history for these two vaccines and their records are not readily obtainable, you should administer the recommended doses. Extra doses will not cause harm to the patient.

Question: Is an egg allergy a contraindication for PCV13 or PPSV23?

No. Both vaccinations are safe for persons with egg allergies.

Question: If my state has a registry, do I still need to give patients vaccine record cards?

Yes. Patient-held cards are an extremely important part of a person's medical history. The person may move to an area without a registry, and a personal record may be the only vaccination record available. In addition, even within a state, all healthcare providers may not participate in the registry, and the personal record card would be needed.

Question: My patient has had laboratory-confirmed pneumococcal pneumonia. Does he/she still need to be vaccinated with PPSV23?

Yes. There are more than 90 known serotypes of pneumococcus (23 serotypes are in the current vaccine). Infection with one serotype does not necessarily produce immunity to other serotypes. As a result, if the person is a candidate for vaccination, he/she should receive it even after one or more episodes of invasive pneumococcal disease.

Question: Why is pneumococcal vaccination recommended for smokers and asthmatics?

In 2008, the Advisory Committee on Immunization Practices (ACIP) reviewed new information that suggests that asthma is an independent risk factor for pneumococcal disease among adults. ACIP also reviewed new information that demonstrates an increased risk of pneumococcal disease among smokers. Consequently, ACIP recommends to include both asthma and cigarette smoking as risk factors for pneumococcal disease among adults age 19 through 64 years and as indications for PPSV23.

Acquired from www.immunize.org on September 4, 2013. We thank the Immunization Action Coalition.
MMWR Morb Mortal Wkly Rep 2012; 61(40):816-819.

Pneumococcal Vaccine

Pneumococcal Vaccination Information Sheet

PCV13 (Pneumovax 13®) and PPSV23 (Pneumovax® 23)

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PPSV23 (Pneumovax®23)

Manufacturer:

Merck
www.merckvaccines.com/Products/Pneumovax/Pages/home

How Supplied:

0.5mL Single Dose Vial
Multi-Dose (5 dose Vial)

Storage and Handling:

Refrigerate on Arrival
Store at 2°C to 8°C
DO NOT FREEZE
Discard after the expiration date

Special instructions:

None

Route of Administration:

0.5mL IM or SQ

PCV13 (Pneumovax13®)

Manufacturer:

Pfizer
<http://www.pfizerpro.com/hcp/prevnar13>

How Supplied:

Prefilled Syringe
(10 per Package)

Storage and Handling:

Refrigerate on Arrival
Store at 2°C to 8°C
DO NOT FREEZE
Discard after the expiration date

Special instructions:

Shake well to obtain a homogeneous white suspension

Route of Administration:

0.5mL IM ONLY

Insurance Carrier Information:

Medicare www.medicarenhic.com 1-866-801-5304*

BCBS of RI www.bcbsri.com/providers 401-274-4848 1-800-230-9050

UnitedHealthCare www.unitedhealthcareonline.com 1-877-842-3210

RI Department of Health State Supplied Vaccination Program www.health.ri.gov/resources/immunization/

Contraindications and Precautions:

- Do not give PPSV23 or PCV13 to patients who have a history of a serious reaction (e.g., anaphylaxis) after a previous dose of PCV13, PPSV23, or one of their components.
- Do not give PPSV23 and PCV13 simultaneously. For vaccine naive patients, give PCV13 first, followed by a dose of PPSV23 ≥ 1 year† (unless patient in a population specified by ACIP to require shorter interval, see page 1). For patients who have already received PPSV23, give PCV13 12 months after the most recent dose of PPSV23.
- Vaccine Co-administration: (1) all vaccines used for routine vaccination in the United States can be given on the same day; (2) an inactivated vaccine can be administered either on the same day as or at any time before or after another inactivated or a live vaccine; and (3) any 2 LIVE vaccines that are not given on the same day must be spaced at least 4 weeks apart. Zoster vaccine is a live, attenuated vaccine; injectable influenza vaccine and pneumococcal polysaccharide vaccine are inactivated vaccines. So these 3 vaccines can be given on the same day or at any time before or after each other. They should be given as separate injections, not combined in the same syringe.

Side Effects:

- Most common side effects from either PPSV23 or PCV13 are soreness and redness at the injection site, lasting 1-2 days.

Drug Information Services 401-874-9188 Monday-Friday 8:30 am - 4:00 pm EST

* An initial pneumococcal vaccine may be administered to all Medicare beneficiaries who have never received a pneumococcal vaccine under Medicare Part B. A different, second pneumococcal vaccine may be administered 1 year after the first vaccine was administered (i.e., 11 full months have passed following the month in which the last pneumococcal vaccine was administered). Please note that the "interval" between the two different pneumococcal vaccines must be at least 11 full months or greater for Medicare reimbursement, not the shorter "interval" recommended for specific populations identified by ACIP.

Acquired from www.immunize.org on September 4, 2013. We thank the Immunization Action Coalition.

† Kobayashi M, Bennett NM, Gierke R, et al. Intervals between PCV13 and PPSV23 vaccines: Recommendations of the Advisory Committee in Immunization Practice (ACIP) MMWR Morb Mortal Wkly Rep. 2015; 64(34): 944-947.

Antibiogram

Percent Susceptible (2015 Isolates)														
Gram Positive Organisms: Inpatient/Outpatient Isolates 2015	Vancomycin	95	75	100	100	100	100	100						
	Sulfamethoxazole /Trimethoprim				100	98	66	89						
	Streptomycin	86	100											
	Tetracycline	29	100	98	98	86	38							
	Penicillin G			28	0	10	100							
	Oxacillin			100	0	47								
	Nitrofurantoin	99	0	100	95	98		100						
	Moxifloxacin												100	
	Gentamicin	73	100	99	97	86								
	Erythromycin		100	72	7	30	100							
	Clindamycin			79	63	52								
	Ciprofloxacin	64	0											
	Chloramphenicol						75							
	Cefotaxime						100							
	Ampicillin	99	25											
Individual Isolates	126	4*	124	111	74	7*								
	<i>Enterococcus faecalis</i>													
	<i>Enterococcus faecium</i>													
	<i>Staphylococcus aureus</i> (MSSA)													
	<i>Staphylococcus aureus</i> , Methicillin-resistant (MRSA)													
	<i>Staphylococcus epidermidis</i>													
	<i>Streptococcus pneumoniae</i>													

*If < 30 isolates use caution extrapolating results; data may be inconclusive for therapeutic efficacy and selection of empiric treatment.

Antibiogram

Percent Susceptible (2015 Isolates)		Tobramycin	Sulfamethoxazole /Trimethoprim	Tetracycline	Piperacillin/tazobactam	Nitrofurantoin	Imipenem	Gentamicin	Ciprofloxacin	Cefuroxime	Ceftriaxone	Ceftazidime	Cefotaxime	Cefepime	Cefazolin	Aztreonam	Ampicillin /Sulbactam	Ampicillin	Amikacin	Individual Isolates	Gram Negative Organisms: Inpatient/Outpatient Isolates 2015
	<i>Acinetobacter baumannii</i>	100	79	64			86	100	83			83	55	79					100	14*	
	<i>Citrobacter freundii</i>	0	67		100	93	100	89	78	33	67		67	89	0	78	33	11	100	9*	
	<i>Enterobacter aerogenes</i>		100		100	0	100	100	100	83	100		100	100	0	100	50	8	100	12*	
	<i>Enterobacter cloacae</i>	0	78		73	26	100	96	94	36	84		82	90	6	82	36	10	100	49	
	<i>Escherichia coli</i>	23	72		94	97	100	88	75	85	92		92	92	85	92	58	52	100	246	
	<i>Klebsiella pneumoniae</i>	0	91		97	37	100	96	91	81	94		94	95	89	91	78	0	99	79	
	<i>Morganella morganii</i>	75	57		100	0	100	71	86	7	86		86	86	7	86	7	7	100	14*	
	<i>Proteus mirabilis</i>	50	76		100	0	96	92	65	92	94		94	94	82	86	88	71	100	49	
	<i>Pseudomonas aeruginosa</i>	98			94		95	77	78			89		93		70			93	109	
	<i>Serratia marcescens</i>	0	100		52	0	100	92	91	0	79		52	96	0	71	0	0	100	23	
	<i>Haemophilus influenzae</i>																	72		25*	
	<i>Klebsiella oxytoca</i>		93		96	83	100	100	93	68	86			89	36	82	61	0	100	28*	
	<i>Stenotrophomonas maltophilia</i>	100																		8*	

*If < 30 isolates use caution extrapolating results; data may be inconclusive for therapeutic efficacy and selection of empiric treatment.

Guidelines for Restricted Antimicrobials

I. The use of the following formulary antimicrobial agents are restricted

Antibiotics	Antifungals
<ul style="list-style-type: none"> Ceftaroline (Teflaro®) Ceftazidime/avibactam (Avycaz®) Ceftolozane/tazobactam (Zerbaxa®) Colistin (Polymyxin E) Dalbavancin (Dalvance®) Daptomycin (Cubicin®) Ertapenem (Invanz®) Fidaxomicin (Dificid®) Fosfomycin (Monurol®) Linezolid (Zyvox®) Oritavancin (Orbactiv®) Polymyxins <ul style="list-style-type: none"> Polymyxin B Colistin (Polymyxin E) Tedizolid (Sivextro®) Tigecycline (Tygacil®) 	<ul style="list-style-type: none"> Amphotericin B lipid complex (AmBisome®) Caspofungin (Cancidas®) Isavuconazonium sulfate (Cresemba®) Voriconazole (V-Fend®)

II. To ensure the rational use of formulary, restricted, or non-formulary antimicrobial agents, the following policies and procedures are to be used:

- When a prescriber wishes to prescribe a restricted or non-formulary antimicrobial agent, he/she shall indicate the “approved” reason (see following pages) in the comments section of the order form. If the use is outside of an approved indication, the physician **MUST** obtain approval of use. This approval must be obtained from the Infectious Diseases consult team, by directly contacting the on-call Infectious Diseases physician/fellow or by calling the Department of Medicine who will contact the on-call Infectious Diseases physician/fellow.
- When pharmacy receives an order for a restricted antimicrobial agent, the pharmacist will verify the “approved” reason for use and if applicable, fill the order. If the pharmacy receives an order for a restricted or non-formulary antimicrobial agent and the ordering box does not indicate an approved reason for use, the pharmacist will immediately contact the prescriber to obtain “criteria for use of a restricted agent.”
- If the prescriber cannot be reached, the pharmacist will dispense a maximum 24 hour supply of the drug. The pharmacist **MUST** notify the prescriber that the further drug will be dispensed only when the completed order form or ID approval is received. It is up to the prescriber to obtain authorization from the Infectious Diseases fellow or Infectious Diseases consult team.

Ceftaroline (Teflaro®)

IV Only

Use requires formal ID Consult

Activity: Coverage against *Staphylococcus aureus* (MSSA and MRSA), *Streptococcus pneumoniae*, most gram-negatives, and some gram-positive anaerobic bacteria

NOT ACTIVE against *Pseudomonas spp.*, *Acinetobacter spp.*, or *Enterococcus spp.*

Criteria for Use:

- Acute bacterial skin and skin structure infection (ABSSSI) caused by MRSA +/- bacteremia or community-acquired bacterial pneumonia (CABP)
- Unable to use vancomycin (VAN; due to intolerance, MIC \geq 2 mg/mL, or infection unresponsive to VAN despite therapeutic concentrations)
- Unable to use other agents (refer to empiric therapy for ABSSSI/CABP)

Unacceptable Uses:

- Treatment of *P. aeruginosa*, *Enterococcus spp.*, or *Acinetobacter spp.* Infections (limited to no activity)
- Treatment of ESBL producing organisms, such as *E. coli* or *Klebsiella spp.* (inactivated by AmpC and ESBL beta-lactamases)
- Known serious hypersensitivity to ceftaroline or other members of the cephalosporin class. Cross-reactivity may occur in patients with a history of other beta-lactam allergies

Dosing in Adults:

- Standard dose: 600 mg IV Q12H
For MSSA/MRSA bacteremia consider: 600 mg IV Q8H
- Renal dose adjustment:
CrCl 30-50 mL/min: 400 mg IV Q12H
CrCl 15-30 mL/min: 300 mg IV Q12H
CrCl <15 mL/min: 200 mg IV Q12H
Hemodialysis: 200 mg IV Q12H
- All infusions should be over 1 hour
- No hepatic dose adjustment

Monitoring:

- Monitor **CBC** for drug-induced **hemolytic anemia** (none observed in studies, but seroconversion from negative to positive Direct Coombs' Test is observed in 10.8% on ceftaroline vs 4.4% on comparator)

ABSSSI= Acute bacterial skin and skin structure infection; CABP= community-acquired bacterial pneumonia; CBC= Complete blood count; CrCl= Creatinine clearance; ESBL= Extended spectrum beta-lactamase; H= hour(s); ID= infectious diseases; IV= Intravenous; MIC= Minimum inhibitory concentration; MRSA= Methicillin-resistant *Staphylococcus aureus*; MSSA= Methicillin-susceptible *Staphylococcus aureus*; Q= every; *spp*= Species; VAN= vancomycin

Ceftazidime/avibactam (Avycaz®)

IV Only

Use requires formal ID Consult

Use reserved for patients who have limited or no alternative treatment options since it was approved based upon limited clinical safety and efficacy data

Activity: Coverage against many resistant gram-negatives such as Enterobacteriaceae and *Pseudomonas aeruginosa*, including some ESBL producers (e.g. CTX-M), carbapenemases (e.g. KPC, some OXA), and AmpCs

NOT ACTIVE against MBLs or gram-negatives that overexpress efflux pumps or have porin mutations, and most anaerobic bacteria

Criteria for Use:

- Treatment of cIAI (in combination with metronidazole) or cUTI, including pyelonephritis, caused by MDR gram-negative organisms

Unacceptable Uses:

- Empiric use without confirmed susceptibility
- Treatment of cIAI and cUTI with other available treatment options
- Known serious hypersensitivity to the components of ceftazidime/avibactam, avibactam-containing products, or other members of the cephalosporin class. Cross-reactivity may occur in patients with a history of penicillin allergy

Dosing in Adults:

- Standard dose: 2.5gm IV Q8H
For cIAI must use in combination with metronidazole
- Renal dose adjustment:
CrCl 31 - 50 mL/min: 1.25gm IV Q8H
CrCl 16-30 mL/min: 0.94gm IVQ12H
CrCl 6-15 mL/min: 0.94gm IV Q24H
CrCl <5 mL/min: 0.94gm IV Q48H
Administer after hemodialysis
- No hepatic dose adjustment anticipated

Monitoring:

- Scr/BUN at baseline and daily; adjust dose accordingly. CBC with differential. Monitor for signs of anaphylaxis with first dose

Considerations for Use:

- Decreased efficacy in patients with = CrCl 30-50 mL/min in clinical trials
- CNS reactions have been reported in patients treated with ceftazidime, particularly in the setting of renal impairment

BUN= blood urea nitrogen; CBC= Complete blood count; cIAI= Complicated intraabdominal infections; CNS= Central nervous system; CrCl= Creatinine clearance; cUTI= complicated urinary tract infections; ESBL= extended-spectrum beta-lactamases; H= hour(s); ID= infectious diseases; IV= Intravenous; KPC= *Klebsiella pneumoniae* carbapenemases; MBL= metallo-beta-lactamases; MDR= multi-drug resistant; Q= every; Scr= Serum creatinine

Ceftolozane/tazobactam (Zerbaxa®)

IV Only

Use requires formal ID Consult

Activity: Coverage against many MDR gram-negatives such as Enterobacteriaceae and *Pseudomonas aeruginosa*. Potent in vitro activity against most *P. aeruginosa* isolates, including some MDR and carbapenem-resistant strains. Inhibits many Enterobacteriaceae, including some ESBL producers (e.g. CTX-M) and some AmpCs

NOT ACTIVE against serine carbapenemases (e.g. KPCs or MBLs)

Criteria for Use:

- Treatment of cIAI (in combination with metronidazole) or cUTI, including pyelonephritis, caused by MDR gram-negative organisms

Unacceptable Uses:

- Empiric use without confirmed susceptibility
- Treatment of cIAI and cUTI with other available treatment options
- Known serious hypersensitivity to ceftolozane/tazobactam, piperacillin/tazobactam, or other members of the beta-lactam class

Dosing in Adults:

- Standard dose: 1500 mg IV Q8H
For cIAI must use in combination with metronidazole
- Renal dose adjustment:
CrCl 30-50 mL/min: 750 mg IV Q8H
CrCl 15-29 mL/min: 375 mg IV Q8H
Hemodialysis: 750mg IV ONCE (load), then 150mg IV Q8H after dialysis
- No hepatic dose adjustment anticipated

Monitoring:

- Scr/BUN, CBC with differential at baseline and daily

Considerations for Use:

- Package insert states decreased efficacy seen in patients with a baseline CrCl <50mL/min or patients ≥65 years of age, in the cIAI trial
- May have a role in the treatment of other infections caused by multidrug resistant gram-negatives, however alternate dosing may be recommended depending on site of infection. ID team must be consulted for all potential on and off label use

BUN= blood urea nitrogen; CBC= Complete blood count; cIAI= Complicated intraabdominal infections; CrCl= Creatinine clearance; cUTI= complicated urinary tract infections; ESBL= extended-spectrum beta-lactamases; ID= infectious disease; IV= Intravenous; KPC= *Klebsiella pneumoniae* carbapenemases; MBL= metallo-beta-lactamases; MDR= multi-drug resistant; Q= every; H= hour(s); Scr= Serum creatinine

Dalbavancin (Dalvance®)

IV Only

Use requires formal ID Consult

Activity: Coverage against *Staphylococcus aureus* (including MSSA and MRSA), *Streptococcus pyogenes*, *Streptococcus agalactiae* (Group B Strep.) and *Streptococcus anginosus* group (including *S. anginosus*, *S. intermedius*, *S. constellatus*)

No clinical data, but activity in vitro vs. *Enterococcus faecalis* (vancomycin-susceptible strains only), *Enterococcus faecium* (vancomycin-susceptible strains only), vancomycin-intermediate *S. aureus* (not vancomycin-resistant strains)

Criteria for Use:

- Treatment of adult patients with acute bacterial skin and skin structure infections (ABSSSI) caused by susceptible gram-positive isolates
- Unable to use vancomycin (due to intolerance, MIC ≥ 2 mg/L, or infection unresponsive to vancomycin despite therapeutic concentrations)
- Unable to use other agents (refer to empiric therapy for ABSSSI)

Unacceptable Uses:

- Infections due to vancomycin-resistant enterococci
- Contraindicated in patients with known hypersensitivity to dalbavancin. Due to the possibility of cross-reactivity to glycopeptide, avoid in patients with previous glycopeptide hypersensitivity due to long half-life

Dosing in Adults:

- Standard dose: Administration should be over 30 minutes
 - 1 Dose Regimen: 1500mg IV once
 - 2 Dose Regimen: 1000mg IV once, then 500mg IV on day 8
- Renal dose adjustment:
 - 1 Dose Regimen CrCl < 30 mL/min 1125 mg IV
 - 2 Dose Regimen CrCl < 30 mL/min: 750mg IV once, then 325mg IV day 8
 - If receiving regularly scheduled hemodialysis: No dosage adjustment
- No hepatic dose adjustment anticipated

Monitoring:

- Baseline BUN/Scr, AST/ALT/bili, CBC w/ diff, infusion-related reactions

Considerations for Use:

- In clinical trials, 6 (0.9%) patients in the dalbavancin arm had ALT elevations greater than 5x ULN including 3 with ALT > 10 x ULN. No subjects in the comparator arm had this degree of ALT elevations

ABSSSI= acute bacterial skin and skin structure infections; ALT= Alanine aminotransferase; AST= Aspartate aminotransferase; bili= Bilirubin; BUN= Blood urea nitrogen; CBC= Complete Blood Count; CrCl= Creatinine clearance; ID= infectious diseases; IV= Intravenous; MIC= Minimum inhibitory concentration; MRSA= Methicillin-resistant *Staphylococcus aureus*; MSSA= Methicillin-susceptible *Staphylococcus aureus*; Scr= Serum creatinine; ULN= Upper Limit of Normal

Daptomycin (Cubicin®)

IV Only

Use requires formal ID Consult

Activity: Coverage against most gram-positive bacteria (including MRSA and VRE)

NOT ACTIVE against gram-negative bacteria

Criteria for Use:

- MRSA bacteremia and/or endocarditis and unable to use vancomycin (due to intolerance, MIC ≥ 2 mg/L, or infection unresponsive to vancomycin despite therapeutic concentrations)
- MRSA skin and skin structure infections in patients with true, serious allergic reaction to vancomycin or linezolid
- Patients receiving vancomycin for > 72 h for resistant staphylococcal skin and skin structure infection without clinical improvement
- VRE confirmed bacteremia (see dosing below, use high doses)

Formal ID consult for use in osteomyelitis or complicated skin and soft tissue infection and all indications that are not listed above

Unacceptable Uses:

- Empiric therapy
- Pneumonia (lung surfactant inactivates daptomycin) or any lower respiratory tract infection

Dosing in Adults:

- Standard dose: 6-10 mg/kg IV Q24H of actual body weight (ABW)
May be dosed 8-10 mg/kg for *Enterococcus* (safety data for healthy volunteers up to 12 mg/kg/day)
- Renal dose adjustment:
CrCl < 30 mL/min: 8 mg/kg IV Q48H
Hemodialysis: 8 mg/kg IV Q48H
- No hepatic dose adjustment

Monitoring:

- Obtain CPK at baseline and weekly. Monitor for muscle pain or weakness, and for signs/symptoms of eosinophilic pneumonia

Considerations for Use:

- Consider discontinuation of concurrent statin therapy while on daptomycin due to additive muscle toxicity

ABW= Actual Body Weight; CPK= Creatine phosphokinase; CrCl= Creatinine clearance; H= hour(s); ID= Infectious Disease; IV= Intravenous; MIC= Minimum inhibitory concentration; MRSA= Methicillin-resistant *Staphylococcus aureus*; Q= every; VRE= Vancomycin-resistant enterococci

Ertapenem (Invanz®)

IV and IM Only

Use requires formal ID Consult

Activity: Coverage against many gram-negatives (including those that produce ESBL), gram-positives, and anaerobes

NOT ACTIVE against *Pseudomonas* spp., *Acinetobacter* spp., MRSA, or *Enterococcus* spp.

Criteria for Use:

- Outpatient treatment of community acquired infections; outpatient settings

Unacceptable Uses:

- Caution use of ertapenem in organisms producing AmpC beta-lactamase without testing the organisms specifically against ertapenem susceptibility
- Contraindicated in patients with documented hypersensitivity to beta-lactams
- Treatment of *P. aeruginosa*, *Acinetobacter* spp., MRSA, or *Enterococcus* spp. Infections

Dosing in Adults:

- Standard dose: 1 gm IV or IM Q24H
- Renal dose adjustment:
 - CrCl < 30 mL/min: 500 mg IV or IM Q24H
 - Hemodialysis: 500 mg IV or IM Q24H; supplemental dose of 150 mg after dialysis if last 500 mg dose given within 6 hours prior to dialysis, no supplemental dose necessary if last 500 mg dose given at least 6 hours prior to dialysis
- No hepatic dose adjustment

Monitoring:

- Fever, CBC, hepatic function, pulmonary function (in pneumonia)

CBC= Complete blood count; CrCl= Creatinine clearance; ESBL= Extended spectrum beta-lactamase; H= hour(s); ID= Infectious Disease; IM= Intramuscular; IV= Intravenous; MRSA= Methicillin-resistant *Staphylococcus aureus*; Q= every; Spp= Species

Fidaxomicin (Difcid®)

PO Only

Use requires formal ID Consult

Patients with multiple *Clostridium difficile* infection (CDI) recurrences (i.e. severe or mild-moderate CDI with greater than 2 and 3 recurrences, respectively) or severe, complicated CDI should obtain ID and/or GI consult for optimal therapy

Criteria for Use:

- Patient with severe CDI with a 2nd recurrence (previously received appropriate therapy [i.e., vancomycin 125 mg PO Q6H for initial and 1st recurrence]). Alternatively, a provider has the option to prescribe a vancomycin taper for a 2nd recurrence

OR

- Patients with mild-moderate CDI with a 3rd recurrence (previously received appropriate therapy i.e., vancomycin 125 mg PO Q6H for initial and 1st recurrence and then a vancomycin taper for the 2nd recurrence)

Unacceptable Uses:

- Treatment of systemic infections
- Treatment of severe, complicated CDI (i.e., life-threatening or fulminant CDI or toxic megacolon)
- Use in combination with PO vancomycin or PO metronidazole

Dosing in Adults:

- Standard dose: 200 mg PO Q12H for 10 days
- No renal or hepatic dose adjustment
- May be given with or without food; systemic absorption is minimal

Considerations for Use:

- Fidaxomicin was only studied in patients with an initial episode or 1st recurrence (defined as within 3 months of initial episode). Recurrence rates in both phase III studies were significantly lower in patients treated with fidaxomicin. However, in a subgroup analysis, recurrence rates were NOT significantly lower in fidaxomicin-treated patients who had the hypervirulent BI/NAP1/027 strain
- The Society for Healthcare Epidemiology in America (SHEA) and Infectious Diseases Society of America (IDSA) Clinical Practice Guidelines for CDI recommend to discontinue therapy with the inciting antimicrobial as soon as possible, as this may influence the risk of CDI recurrence

CDI= Clostridium difficile infection; FDA= Food and Drug Administration; GI= gastrointestinal; H= hour(s); ID= infectious diseases; IDSA= Infectious Diseases Society of America; PO= Oral; Q= every; SHEA= Society for Healthcare Epidemiology in America

Fosfomycin (Monurol®)

PO Only

Use requires formal ID Consult

Activity: Coverage against many gram-negatives (including ESBL-producing and carbapenem-resistant Enterobacteriaceae [such as *E. coli*, *Klebsiella* spp.]) and gram-positives (including MRSA and VRE)

NOT ACTIVE against *Acinetobacter* spp.

In the United States only the oral formulation is available.

Criteria for Use:

- Management of uncomplicated UTI in patients with multiple antibiotic allergies and/or when no other oral therapy options are available
- Uncomplicated UTI due to VRE
- Salvage therapy for UTI due to multi-drug resistant organisms (e.g. ESBL, VRE, +/- *Pseudomonas*; confirm fosfomycin susceptibility prior to initiation of therapy)

Unacceptable Uses:

- Management of any infections outside of the urinary tract. Oral fosfomycin does not achieve adequate concentrations at other sites
- Treatment of asymptomatic bacteriuria

Dosing in Adults:

- Standard dose:
 - Uncomplicated UTI: 3 gm (1 sachet) PO once
 - Complicated UTI: 3 gm (1 sachet) PO every 2 to 3 days (up to 21 days of treatment)
 - Powder should be mixed with 90-120 mL of cool water, stirred to dissolve and administered immediately. May be administered with or without food
- Renal dose adjustment:
 - CrCl < 50 mL/min: Frequency adjustment may be necessary; contact antimicrobial stewardship team
- No hepatic dose adjustment

Monitoring:

- Signs and symptoms of urinary tract infection

CrCl= Creatinine clearance; ESBL= Extended spectrum beta-lactamase; ID= Infectious Disease; MRSA= Methicillin-resistant *Staphylococcus aureus*; PO= Oral; Spp= Species; UTI= Urinary Tract Infection; VRE= Vancomycin-resistant enterococci

Linezolid (Zyvox®)

IV and PO Only

Use requires formal ID Consult

Activity: Coverage against *Staphylococcus aureus* (MSSA and MRSA), *Streptococcus pneumoniae*, VRE

Criteria for Use:

- Vancomycin (VAN) MIC \geq 2 mg/L in MRSA pneumonia
- Patient with allergy to beta-lactams/vancomycin and organism resistant to other antimicrobials
- Significant VRE infections (i.e. isolated from a sterile site: blood, abscess)
- Infections due to MRSA in patient with well documented intolerance to VAN
(**NOTE:** Red man syndrome is not a serious intolerance to VAN)

Formal ID consult for use in osteomyelitis or complicated skin and soft tissue infection and all indications that are not listed above

Unacceptable Uses:

- Empiric use when VRE has not been cultured or documented
- Uncomplicated urinary tract infection
- Positive respiratory culture for VRE
- VRE colonization

Dosing in Adults:

- Standard dose: 600 mg PO or IV Q12H
In patients tolerating PO medications, should be given orally
Oral formulation is completely absorbed and has 100% availability
- No renal or hepatic dose adjustment

Monitoring:

- CBC at baseline and weekly (**MONITOR platelets at baseline and weekly**)

Considerations for Use:

- Caution in patients with thrombocytopenia. 3 percent of patients were noted to have a platelet decrease $<75\%$ of baseline or lower limit of normal in controlled trials (therapy <28 days, most <21 days. **Thrombocytopenia is reversible upon discontinuation and is correlated with duration**)
- Linezolid is a weak MAOI. Use in caution with decongestants (i.e. pseudoephedrine) and serotonergic agents (i.e. SSRIs [fluoxetine, escitalopram, sertraline, paroxetine, citalopram])
Warn patients to avoid large quantities of tyramine containing foods

CBC= Complete blood count; H= hour(s); ID= infectious disease; IV= Intravenous; MAOI= Monoamine oxidase inhibitors; MIC= Minimum inhibitory concentration; MRSA= Methicillin-resistant *Staphylococcus aureus*; MSSA= Methicillin-susceptible *Staphylococcus aureus*; PO= Oral; Q= every; SSRI= serotonin-specific reuptake inhibitors; VAN= Vancomycin; VRE= Vancomycin-resistant enterococci

Oritavancin (Orbactiv®)

IV Only

Use requires formal ID Consult

Activity: Coverage against *Staphylococcus aureus* (MSSA and MRSA), *Streptococcus pyogenes*, *Streptococcus agalactiae*, *Streptococcus dysgalactiae*, *Streptococcus anginosus* group and vancomycin-susceptible *Enterococcus faecalis*

No clinical data, but activity in vitro vs. vancomycin-resistant enterococci and vancomycin-intermediate and vancomycin-resistant *Staphylococcus aureus*

Criteria for Use:

- Treatment of adult patients with acute bacterial skin and skin structure infections (ABSSSI) caused by susceptible gram-positive isolates
- Unable to use vancomycin (due to intolerance, MIC ≥ 2 , or infection unresponsive to vancomycin despite therapeutic concentrations)
- Unable to use other agents (refer to empiric therapy for ABSSSI)

Unacceptable Uses:

- Patients with suspected osteomyelitis. If OM is suspected, alternative antibacterial therapy should be initiated
- Contraindicated in patients with known hypersensitivity to oritavancin. Due to the possibility of cross-reactivity to glycopeptide, avoid in patients with previous glycopeptide hypersensitivity due to long half-life.

Dosing in Adults:

- Standard dose: 1200mg dose IV over 3 hours x1
- No renal or hepatic dose adjustment

Monitoring:

- SCr/BUN, AST, ALT, bilirubin, infusion-related reactions (pruritus, urticaria, flushing), hypersensitivity reactions, signs/symptoms of OM

Considerations for Use:

- **The use of unfractionated heparin is contraindicated for 48 hours after oritavancin administration due to artificial prolongation of aPTT**
- Co-administration of oritavancin and warfarin may result in higher exposure of warfarin, which may increase the risk of bleeding
- Oritavancin can artificially prolong aPTT for up to 120 Hr, and may prolong PT and INR for up to 12 Hr and ACT for up to 24 Hrs

ABSSSI= acute bacterial skin and skin structure infections; ACT= Activated clotting time; ALT= Alanine aminotransferase; aPTT= Activated partial thromboplastin time; AST= Aspartate aminotransferase; BUN= Blood urea nitrogen; ID= Infectious Disease; INR= International normalized ratio; IV= Intravenous; MIC= Minimum inhibitory concentration; MRSA= Methicillin-resistant *Staphylococcus aureus*; MSSA= Methicillin-susceptible *Staphylococcus aureus*; OM= osteomyelitis; PT= Prothrombin time; SCr= Serum creatinine

Polymyxin B

IV Only

Use requires formal ID Consult

Polymyxin B and Colistin (also known as Polymyxin E or Colistimethate) are the two polymyxin antibiotics. Their spectrum of activity is similar. However, their pharmacology is very different. Polymyxin B is administered as the active drug and is not cleared renally. Colistin is a prodrug (Colistimethate sodium) and is cleared renally.

The product vials may be labeled as International Units (IU) or mg.

To avoid major dosing errors, carefully read vial labels. Recommend that all doses be converted to mg.

Conversion: 10,000 International Units = 1 mg

Activity: Coverage against most gram-negatives, including many multi-drug resistant (MDR) Enterobacteriaceae (such as *E. coli*, *Klebsiella* spp.; including ESBL-producing and carbapenem-resistant Enterobacteriaceae), *Pseudomonas* spp., and *Acinetobacter* spp.

NOT ACTIVE against *Proteus*, *Serratia*, *Providencia*, *Burkholderia*, *Stenotrophomonas*, gram-negative cocci, gram-positive organisms, or anaerobes

Criteria for Use:

- Treatment of infections due to MDR Enterobacteriaceae, *Pseudomonas* spp., and *Acinetobacter* spp. with **no other** treatment options

Unacceptable Uses:

- Empiric treatment of suspected gram-negative infections
- Monotherapy for serious infections due to rapid resistance development
- Treatment of UTIs. Colistin preferred over polymyxin B for UTIs

Dosing in Adults: Optimal dosing regimens are not well established

- Standard dose: 2.5 mg/kg IV as a 2 hr infusion ONCE (load), then 12 hours later start 1.5 mg/kg IV as a 1 hr IV infusion. Repeat Q12H
- No renal or hepatic dose adjustment
- Use **actual body weight** for dosing
- **Caution in use > maximum product recommended daily dose (300mg)**

Monitoring:

- BUN/ SCr at baseline and at least twice weekly

Considerations for Use:

- The most important side effect of IV polymyxin B is nephrotoxicity (20-40% of patients); less frequently reported concerns include neurotoxicity and neuromuscular blockade
- Recent literature suggests that nephrotoxicity rates may be lower with polymyxin B as compared to colistin

BUN= Blood urea nitrogen; ESBL= Extended spectrum beta-lactamase; H= hour(s); ID= Infectious Diseases; IU= international Units; IV= Intravenous; MDR= multi-drug resistant; Q= every; SCr= Serum creatinine; spp= Species; UTI= Urinary tract infection

Colistin (Polymyxin E or Colistimethate)

IV Only

Use requires formal ID Consult

Colistin (also known as Polymyxin E or Colistimethate) and Polymyxin B are the two different polymyxin antibiotics. Colistin is a prodrug (Colistimethate sodium). The product vials may be labeled as International Units (IU) of prodrug, or mg of the active product: colistin base activity (CBA).

To avoid major dosing errors, carefully read vial labels.

Recommend that all doses be converted to mg of CBA.

Conversion: 1,000,000 units of Colistimethate (prodrug) = 80 mg of Colistimethate (prodrug) = 30 mg of colistin base activity (CBA)

Activity: Coverage against most gram-negatives, including many multi-drug resistant (MDR) Enterobacteriaceae (such as *E. coli*, *Klebsiella spp.*; including ESBL-producing and carbapenem-resistant Enterobacteriaceae), *Pseudomonas spp.*, and *Acinetobacter spp.*

NOT ACTIVE against *Proteus spp.*, *Serratia spp.*, *Providencia spp.*, *Burkholderia spp.*, *Stenotrophomonas spp.*, gram-negative cocci, gram-positive organisms, or anaerobes

Criteria for Use:

- Treatment of infections due to MDR Enterobacteriaceae, *Pseudomonas spp.*, and *Acinetobacter spp.* with **no other** treatment options
- Treatment of UTI. Colistin preferred over polymyxin B for UTIs

Unacceptable Uses:

- Empiric treatment of suspected gram-negative infections
- Use as monotherapy due to rapid resistance development

Dosing in Adults: Optimal dosing regimens are not well established

- Standard dose: 5 mg CBA/kg ONCE (load), then 2.5 mg CBA/kg Q12H
- Renal dose adjustment:
 - CrCl 20-50 mL/min: 5 mg CBA/kg ONCE (load), then 2.5 mg CBA/kg Q24H
 - CrCl < 20 mL/min: 5 mg CBA/kg ONCE (load), then 2.5 mg CBA/kg Q48H
 - Hemodialysis: 5 mg CBA/kg ONCE (load), then 30 mg CBA IV Q12H, AD
- No hepatic dose adjustment
- Use **ideal body weight** in obese patients for dosing
- **Caution in use > max product recommended daily dose (300 mg CBA)**

Monitoring:

- BUN/ SCr at baseline and at least twice weekly

Considerations for Use:

- The most important side effect of IV colistin is nephrotoxicity (rates 50-60% of patients); less frequently reported concerns include neurotoxicity and neuromuscular blockade

AD= After dialysis; BUN= Blood urea nitrogen; CBA= Colistin base activity; CrCl= Creatinine clearance; ESBL= Extended spectrum beta-lactamase; H= hour(s); ID= infectious diseases; IU= international units; IV= Intravenous; MDR= multi-drug resistant; Q= every; SCr= Serum creatinine; spp= species; UTI= Urinary tract infection

Tedizolid (Sivextro®)

IV and PO Only

Use requires formal ID Consult

Activity: Coverage includes *Staphylococcus aureus* (MSSA and MRSA), *Streptococcus pyogenes*, *Streptococcus agalactiae*, *Streptococcus anginosus* group, and *Enterococcus faecalis*

Criteria for Use:

- Treatment of adult patients with acute bacterial skin and skin structure infections (ABSSSI) caused by susceptible gram-positive isolates
- Unable to use vancomycin (due to intolerance, MIC ≥ 2 , or infection unresponsive to vancomycin despite therapeutic concentrations)
- Unable to use other agents (refer to empiric therapy for ABSSSI)

Unacceptable Uses:

- Infections for other indications not listed above
- Patients with neutropenia. Safety and efficacy in patients with neutrophil counts <1000 cells/mm³ have not been assessed. Decreased activity in the absence of granulocytes in animal models

Dosing in Adults:

- Standard dose: 200 mg IV/PO once daily for 6 days
- No renal or hepatic dose adjustment
- No dose adjustment is necessary when changing from IV to PO

Monitoring:

- CBC with differential

Considerations for Use:

- Tedizolid has been shown to be a reversible inhibitor of monoamine oxidase (MAO) in vitro, but no restrictions exist for concomitant use of drugs with serotonergic and adrenergic activity or tyramine containing foods. Of note, patients taking such medications were excluded from clinical trials. In vitro, in vivo, and clinical studies indicate weak MAO inhibition and a low potential for serotonergic adverse consequences
- In phase 3 trials, reduction in hemoglobin, reduction in platelet count, and reduction in absolute neutrophil count were similar between tedizolid and linezolid
- In phase 3 trials, adverse effects associated with neurologic and optic nerve disorders did not differ between tedizolid and linezolid

ABSSSI= acute bacterial skin and skin structure infections; CBC= Complete Blood Count; ID= Infectious Disease; IV= Intravenous; MAO= monoamine oxidase; MIC= Minimum inhibitory concentration; MRSA= Methicillin-resistant *Staphylococcus aureus*; MSSA= Methicillin-susceptible *Staphylococcus aureus*; PO= By Mouth

Tigecycline (Tygacil®)

IV Only

Use requires formal ID Consult

Activity: Coverage against MRSA, VRE, most gram-negatives, and anaerobes

NOT active against *Pseudomonas aeruginosa* or *Proteus* spp.

Criteria for Use:

- Alternative therapy in patients with mixed aerobic-anaerobic infections and severe allergy to beta-lactam agents, if VRE or MRSA are involved
- Alternative therapy for patients with systemic infections due to ESBL-producing organisms (*Klebsiella* spp., *E. coli*) with severe allergies to first-line therapy (imipenem/cilastatin or meropenem)
- Alternative therapy for selected isolates of *Acinetobacter*, *Stenotrophomonas*, and VRE
- Treatment of documented VRE infections in patients unable to take linezolid

Unacceptable Uses:

- Treatment of *P. aeruginosa* or *Proteus* spp. infections
- Urinary tract infections (low urinary concentrations)
- Peak serum concentrations do not exceed 1 mcg/mL, which limits its use for treatment of bacteremia

Dosing in Adults:

- Standard dose: 100 mg IV load x1, then 50 mg IV Q12H (use higher doses for infections due to *Acinetobacter* and other MDR organisms)
Infuse each dose over 30 to 60 minutes
- No renal dose adjustment
Supplemental dosing is not necessary following hemodialysis
- Hepatic dose adjustment:
Severe hepatic disease (Child Pugh C): 100mg IV load x1, then 25 mg IV Q12H

Important Side Effects:

- Nausea and vomiting (most common in first 1-2 days of therapy)
- To minimize GI side effects avoid fasting state administration
- Prolonging the infusion time (>1 hour) may make GI side effects worse
- Shortening infusion time (<30 minutes) may increase the incidence of infusion related reactions (inflammation, pain, phlebitis, other)

Management of tigecycline-induced nausea and vomiting:

- Ondansetron (Zofran®): Single dose of 8-12 mg IV or 8-24 mg PO

ESBL= Extended spectrum beta-lactamase; GI= Gastrointestinal; H= hour(s); ID= infectious diseases; IV= Intravenous; MDR= multi-drug resistant; MRSA= Methicillin-resistant *Staphylococcus aureus*; PO= by mouth; Q= every; spp= species; VRE= Vancomycin-resistant enterococci

Liposomal Amphotericin B (L-AMB)(AmBisome®)

IV Only

Use requires formal ID Consult

Activity: Broad-spectrum antifungal activity with in vitro activity against *Candida*, *Cryptococcosis*, *Aspergillus*, *Zygomycosis*, and *Fusarium*

Dosing of AmBisome and Amphotericin B deoxycholate is **significantly different and not interchangeable**. Do not use AmBisome doses when ordering Amphotericin B deoxycholate and vice versa

Criteria for Use:

- Pre-existing renal insufficiency defined as SCr of ≥ 2 mg/dL or calculated CrCl of ≤ 25 mL/min, or SCr doubled from baseline
- Patient refractory to or cannot tolerate conventional amphotericin B deoxycholate
- SCr > 1.5 mg/dL and receiving concomitant cyclosporine or tacrolimus
- Patients with irreversible ESRD on chronic HD or PD should receive **amphotericin B deoxycholate**

Dosing in Adults:

- Standard dose:
 - Febrile neutropenia: 3 mg/kg/day, may consider 5 mg/kg/day in patients with neutropenia > 10 days, evidence of fungal infection, or clinically unstable
 - Documented yeast (*Candida* spp., others) infection: 3-5 mg/kg/day
 - Documented mold (*Aspergillus* spp., others) infection: 3-5 mg/kg/day
 - Endophthalmitis: 5 mg/kg/day \pm Flucytosine 25 mg/kg PO Q6H
 - Endocarditis: 5 mg/kg/day
 - Cryptococcal meningitis: 4 mg/kg/day \pm Flucytosine 25 mg/kg PO Q6H
- No renal/ hepatic dose adjustment

Monitoring:

- BUN/SCr, K, Mg, Phos at baseline and daily in hospitalized patients; AST/ALT at baseline and every 1-2 weeks

ALT= Alanine aminotransferase; AST= Aspartate aminotransferase; BUN= Blood urea nitrogen; CrCl= Creatinine clearance; ESRD= End-stage renal disease; H= hour(s); HD= Hemodialysis; ID= infectious diseases; IV= Intravenous; K= Potassium; Mg= Magnesium; PD= Peritoneal dialysis; Phos= Phosphorus; PO= by mouth; Q= every; SCr= Serum creatinine; spp= species

Caspofungin (Cancidas®)

IV Only

Use Requires Formal ID Consult

Criteria for Use:

Invasive Aspergillosis:

- Patients refractory to or who cannot tolerate conventional amphotericin B, liposomal amphotericin B, or voriconazole
- In combination with voriconazole or amphotericin B in patients with documented invasive aspergillosis

Systemic *Candida* infections:

- Systemic *Candida* infections secondary to *C. glabrata* or *C. kruseii* and other non-*Candida albicans* (pending fluconazole susceptibility testing)
- Patients unable to tolerate conventional amphotericin B or patients with concomitant renal insufficiency as per liposomal amphotericin B guidelines
- Patients unable to tolerate fluconazole as defined by a serious rash, tripling of baseline LFTs, or other adverse reaction
- Empiric use until non-*albicans* is confirmed

Dosing in Adults:

- Standard dose: 70 mg IV x1, then 50 mg IV Q24H
- No renal dose adjustment
- Hepatic dose adjustment:
 - Moderate hepatic impairment: 70 mg IV x1, then 35 mg IV Q24H
- Patients receiving rifampin or phenytoin:
 - Consider 70 mg IV Q24H (due to enzyme induction effect)

Monitoring:

- Aspartate aminotransferase (AST)/ Alanine aminotransferase (ALT) at baseline and weekly

ALT= Alanine aminotransferase; AST= Aspartate aminotransferase; H= hour(s); ID= infectious diseases; IV= Intravenous; LFTs= Liver Function Tests; PO= by mouth; Q= every

Isavuconazonium sulfate (Cresemba®)

IV and PO Only

Use requires formal ID Consult

Activity: Coverage against most strains of the following microorganisms, both in vitro and in clinical infections: *Aspergillus flavus*, *Aspergillus fumigatus*, *Aspergillus niger*, and Mucorales such as *Rhizopus oryzae* and Mucormycetes species

Criteria for Use:

- Treatment of invasive aspergillosis
- Treatment of invasive mucormycosis

Unacceptable Uses:

- Treatment for other fungal infections (*Blastomyces*, *Histoplasma*, etc.)
- Contraindicated with known hypersensitivity to isavuconazole. Caution in use in patients with hypersensitivity to other azoles
- Contraindicated in patients with familial short QT syndrome (shortens the QTc interval in a concentration-related manner)

Dosing in Adults:

- Standard dose: 372 mg IV/PO Q8H x 6 doses (48 hours; load), then 372 mg Q24H starting 12-24 hours after last loading dose
- No renal or hepatic dose adjustment
- IV must be administered via an infusion set with in-line filter (pore size 0.2-1.2 micron) and should be infused over a minimum of 1 hour
- No dose adjustment is necessary when changing from IV to PO

Monitoring:

- AST/ALT/bilirubin at baseline and every 1-2 weeks after

Considerations for Use:

- Elevated LFTs have been reported in clinical trials. Elevations generally reversible and do not require discontinuation
- May cause fetal harm when administered to a pregnant woman

Important note regarding drug interactions:

- Isavuconazole is a substrate/inhibitor of CYP3A4 and has multiple drug interactions that may affect its levels and/or those of co-administered drugs. Dose adjustment may be necessary
- Some drugs with interactions of major significance include:
 - Carbamazepine
 - Rifampin/rifabutin
 - Ritonavir
 - Sirolimus
 - Cyclosporine
 - Warfarin
 - Tacrolimus
 - Phenytoin

ALT= Alanine aminotransferase; AST= Aspartate aminotransferase; H= hour(s); ID= infectious diseases; IV= Intravenous; LFT's= Liver Function Tests; PO= by mouth; Q= every

Voriconazole (V-Fend®)

IV and PO Only

Use requires formal ID Consult

Activity: Does not cover zygomycoses (*Mucor*, *Rhizopus*, *Cunninghamella*, etc.).

Criteria for Use:

- Treatment of documented invasive aspergillosis
- Used in combination with caspofungin in microbiologically or radiographically confirmed *Aspergillus*
- Serious mycosis infections due to *Fusarium* spp., *Scedosporium apiospermum*

Dosing in Adults:

- Standard dose:
PO: 400 mg PO x2 doses (load), then 200 mg PO Q12H (oral formulation may be used without dose adjustment)
IV: 6 mg/kg IV x2 doses (load), then 4 mg/kg IV Q12H
In patients tolerating PO medications, should be given orally
Voriconazole oral formulation is >95% bioavailable
- Renal dose adjustment:
IV voriconazole should be avoided in patients with CrCl < 50 mL/min due to visual disturbances and accumulation of cyclodextran vehicle (excipient)
- Hepatic dose adjustment:
Moderate hepatic impairment: ½ maintenance dose (PO: 100mg PO q12H; IV: 2 mg/kg IV Q12H)

Monitoring:

- Aspartate aminotransferase (AST)/ Alanine aminotransferase (ALT)/ bilirubin at baseline and every 1-2 weeks after

Important note regarding drug interactions:

- Voriconazole has multiple drug interactions that may affect its levels and/or those of co-administered drugs. Dose adjustment may be necessary
- Some drugs with interactions of major significance include:
 - Carbamazepine
 - Rifampin/rifabutin
 - Ritonavir
 - Sirolimus
 - Tacrolimus
 - Cyclosporine
 - Warfarin
 - Phenytoin

ALT= Alanine aminotransferase; AST= Aspartate aminotransferase; CrCl= Creatinine Clearance; H= hour(s); ID= infectious diseases; IV= Intravenous; PO= by mouth; Q= every; spp= species

Guidelines for Vancomycin Dosing and Determination of Trough Levels in Adult Patients

Refer to Vancomycin Dosing Nomogram OR calculate dose as described below:

I. How to calculate a vancomycin dose:

- a) Obtain actual body weight (ABW)

NOTE: do not calculate dose based on lean body weight; if morbidly obese use ABW for initial loading dose and monitor trough or consult ID.

- b) Loading Dose (LD): For **more** severe infections (i.e., Meningitis, endocarditis, pneumonia, etc.) consider a loading dose of 25-30 mg/kg ABW

LD = 25-30 mg/kg (Use ACTUAL body weight)

- c) Maintenance dose (MD): Calculate each maintenance dose:

MD = 15 mg/kg (Use ACTUAL body weight)

- d.) Special Populations:

Morbid obesity ($\geq 130\%$ of IBW) use 30 mg/kg/day divided Q8H as obese patients often require more frequent dosing intervals (i.e., Q8H)^{1,2,3} Obese patients rarely need doses in excess of 3.5 gm per day. Suggest starting at 1 to 1.25 gm Q8H and adjust upward if necessary.

Round calculated dose: doses should be rounded to the nearest 250 mg increment (i.e., 500 mg, 750 mg, 1000 mg, 1250 mg, 1500 mg, etc.)

II. Estimate patient's creatinine clearance (CrCl)

Use the Cockcroft-Gault equation. (See Pharmacokinetic Section for equation)

III. Select dosing interval based on CrCl

Estimated CrCl (mL/min)	Dosing interval to consider
≥ 100	Q8H
80-99	Q8H or Q12H
50-79	Q12H
25-49	Q18H or Q24H
< 25 mL/min	Q36H or Q48H
Hemodialysis (check pre-dialysis level)	Give an initial loading dose of 15-20 mg/kg Re-dose patient with 15 mg/kg when serum level ≤ 20 mcg/mL
Peritoneal dialysis (IV administration)	

If the estimated renal function (CrCl) is near the border of two dosing intervals, it may be reasonable to begin with the more aggressive interval; the dose can then be modified if necessary according to serum levels.

ABW= Actual body weight; CrCl= Creatinine clearance; H= hour(s); IBW= ideal body weight; ID= infectious diseases; LD= loading dose; MD= maintenance dose; Q= every

References:

1. Bauer LA, Black DJ, Lill JS. Vancomycin dosing in morbidly obese patients. *Eur J Clin Pharmacol*. 1998 Oct;54(8):621-5.
2. Vance-Bryan K, Guay DR, Gilliland SS, et al. Effect of obesity on vancomycin pharmacokinetic parameters as determined by using a Bayesian forecasting technique. *Antimicrob Agents Chemother*. 1993 Mar;37(3):436-40.
3. Blouin RA, Bauer LA, Miller DD, et al. Vancomycin pharmacokinetics in normal and morbidly obese subjects. *Antimicrob Agents Chemother*. 1982 Apr;21(4):575-80.

Guidelines for Vancomycin Dosing and Determination of Trough Levels in Adult Patients

IV. Vancomycin Levels

Vancomycin levels are **NOT** needed in patients with stable renal function who are on standard doses of vancomycin **AND** are on therapy for less than 5 days. Vancomycin peak levels are rarely, if ever, indicated.

NOTE: Vancomycin demonstrates concentration-independent killing; therefore, peak concentrations are **NOT** useful or correlated to clinical outcomes.

Measure Trough Concentrations Only if:

- Patient is receiving vancomycin therapy > 5 days
- Patient has unstable renal function
- Patient is on an unusual/aggressive dosing regimen
- Patient is morbidly obese (> 130% of IBW)
- Patient has severe or life threatening infection and is receiving concomitant nephrotoxic drugs (i.e., cyclosporine, amphotericin B, aminoglycosides)

V. Implications for NURSING

Vancomycin needs to accumulate (steady state concentration) in order to obtain an accurate concentration. **Please DO NOT order a plasma level unless 3 doses have been administered on a given schedule** (i.e., order trough prior to the 4th dose) **Exception:** Dosing interval of 24 hours or longer

Trough level should be drawn within 30 minutes of the next dose

- Check what time the previous vancomycin dose (prior to the trough) was administered
- Calculate how many hours are between the dose and level
- Interpret the level in the context of recent vancomycin doses

Example: If the patient is on 1gm Q12H and received a dose at 11pm, then a level taken at 6am is 7 hours post-dose and is **NOT** a trough level.

- Be careful **NOT** to adjust **OR** hold vancomycin doses based on incorrectly drawn levels
- Do **NOT** hold the next dose while waiting for trough results
(sub-therapeutic levels <15mcg/mL are not effective and can lead to resistant pathogens)

H= hour(s); IBW= Ideal body weight; Q= every

Guidelines for Vancomycin Dosing and Determination of Trough Levels in Adult Patients

VI. Target Trough Vancomycin Level

Type of Infection	Target Trough Vancomycin Level
MRSA pneumonia, CNS infection (meningitis), bacteremia, endocarditis, osteomyelitis	15-20 mcg/mL
Endovascular Infection	15-20 mcg/mL
Hemodialysis	Maintain 15-20 mcg/mL Check pre-dialysis level, re-dose when ≤ 20 mcg/mL Often recommend to load with 15 – 20 mg/kg and re-dose
Serious infection and renal dysfunction (CrCl < 25mL/min)	If ≥ 24 H dosing check trough at 24 hours Maintain 15-20 mcg/mL

VII. Adjusting a vancomycin dose (Recommendations)

Trough is too low- change the interval, keep the dose

- If the level is < 5 mcg/mL, the dosing INTERVAL should be shortened

Example: Trough level after 5 days of treatment reported as 3 mcg/mL on a regimen of 1000 mg Q12H, the interval should be shortened to 1000 mg Q8H

Trough is too high- decrease the dose, keep the interval

- If the trough level is >25 mcg/mL, the DOSE should be decreased 50%

Example: Trough level after 5 days of treatment is reported as 29 mcg/mL on a regimen of 1000 mg Q12H; the dose should be decreased to 500 mg Q12H

VIII. Monitoring (Inpatient)

- Baseline weight, BUN, serum creatinine, WBC, temperature, cultures, and sensitivities should be taken every other day in stable patients
- Daily urinary IN's and OUT's, CBC, and temperature should be monitored; should be performed in patients admitted to the ICU

BUN= Blood urea nitrogen; CBC= Complete Blood Count; CNS= Central nervous system; CrCl= Creatinine clearance; H= hour(s); ICU= Intensive Care Unit; MRSA= Methicillin-resistant Staphylococcus aureus; Q= every; WBC= White blood cells

Vancomycin Dosing Nomogram

CrCl (mL/min) Weight (kg)		Cr Cl in mL/min							
		30	40	50	60	70	80	90	≥100
weight in kg	30	500mg q24h	500mg q24h	500mg q12h	500mg q12h	500mg q12h	500mg q8/12h	500mg q8/12h	500mg q8h
	35	500mg q24h	500mg q24h	500mg q12h	500mg q12h	500mg q12h	500mg q8/12h	500mg q8/12h	500mg q8h
	40	500mg q24h	500mg q24h	500mg q12h	500mg q12h	500mg q12h	500mg q8/12h	500mg q8/12h	500mg q8h
	45	750mg q24h	750mg q24h	750mg q12h	750mg q12h	750mg q12h	750mg q8/12h	750mg q8/12h	750mg q8h
	50	750mg q24h	750mg q24h	750mg q12h	750mg q12h	750mg q12h	750mg q8/12h	750mg q8/12h	750mg q8h
	55	1g q24h	1g q24h	1g q12h	1g q12h	1g q12h	750mg q8/12h	750mg q8/12h	750mg q8h
	60	1g q24h	1g q24h	1g q12h	1g q12h	1g q12h	1g q8/12h	1g q8/12h	1g q8h
	65	1g q24h	1g q24h	1g q12h	1g q12h	1g q12h	1g q8/12h	1g q8/12h	1g q8h
	70	1g q24h	1g q24h	1g q12h	1g q12h	1g q12h	1g q8/12h	1g q8/12h	1g q8h
	75	1.25g q24h	1.25g q24h	1.25g q12h	1.25g q12h	1.25g q12h	1.25g q8/12h	1.25g q8/12h	1.25g q8h
	80	1.25g q24h	1.25g q24h	1.25g q12h	1.25g q12h	1.25g q12h	1.25g q8/12h	1.25g q8h	1.25g q8h
	85	1.25g q24h	1.25g q24h	1.25g q12h	1.25g q12h	1.25g q12h	1.25g q8/12h	1.25g q8h	1.25g q8h
	90	1.25g q24h	1.25g q24h	1.25g q12h	1.25g q12h	1.25g q12h	1.25g q8/12h	1.25g q8h	1.25g q8h
	95	1.5g q24h	1.5g q24h	1g q8h	1g q8h	1g q8h	1.5g q8h	1.5g q8h	1.5g q8h
≥100		Contact Antimicrobial Stewardship Team			If Patient is obese: 30mg/kg/day in divided doses q8h				

Guidelines for Administration of High Dose Once Daily Aminoglycosides (HDOD)

High Dose Once Daily Aminoglycosides (HDOD) are considered safe and effective in patients with stable renal function

Exclusion Criteria for HDOD:

If patients fall into the following categories, use traditional/conventional dosing since there is limited data using HDOD in the following patient populations

Acute renal failure <u>OR</u> CrCl < 20 mL/min	Age < 18 OR > 90
Half-life ($t_{1/2}$) \geq 4 hours	Severe burns
Dialysis	Ascites

To use Traditional Dosing Methods, see
www.globalrph.com “medical calculator”

For AMG dosing, contact the Antimicrobial Stewardship team
or follow the steps below:

- I. Calculate the patient's Ideal Body Weight (IBW)
Male: 50 kg + [2.3 kg for each inch over 5 feet]
Female: 45 kg + [2.3 kg for each inch over 5 feet]
- II. Determine the dose based on the table below (round dose to the nearest 20 mg)

Aminoglycoside	Maintenance Dose
Tobramycin	5 mg/kg (IBW)
Gentamicin	5 mg/kg (IBW)

- Dose is based on **IBW** except in obese patients OR those under their IBW
- Use **ABW** if patient weight is less than IBW
- Use **AdjBW** in patients who are obese (\geq 130% of IBW)

Adjusted Body Weight (AdjBW) Calculation

$$\text{AdjBW} = 0.4 (\text{ABW} - \text{IBW}) + \text{IBW}$$

- III. Estimate the patient's creatinine clearance (CrCl) using the Cockcroft and Gault equation (refer to Pharmacokinetic Section)
- IV. Select dosing interval based on calculated CrCl from the tables below:

CrCl (mL/min)	Estimated Dosing Interval
\geq 60	Every 24 hours
40–59	Every 36 hours
20–39	Every 48 hours
\leq 20	Use traditional dosing method, see www.globalrph.com “medical calculator”

ABW= Actual Body Weight; AdjBW= Adjusted Body Weight; AMG= aminoglycosides (i.e., gentamicin and tobramycin);
CrCl= Creatinine clearance; HDOD= High Dose Once Daily Aminoglycosides; IBW= Ideal Body Weight (in kg); $t_{1/2}$ = half life

Guidelines for Administration of High Dose Once Daily Aminoglycosides (HDOD)

V. Commonly Targeted Peak and Trough Concentrations in HDOD

Disease State	Gentamicin/Tobramycin		Amikacin	
	Recommended Peak (mcg/mL)	Estimated mg/kg (IBW)	Recommended Peak (mcg/mL)	Estimated mg/kg (IBW)
Cystitis	6–8	2–3	30–40	10–15
Gram-Positive Synergy	6–8	2–3	30–40	10–15
Pyelonephritis	12–14	3–4	60–70	20
Pneumonia	16–20	5–6	60–80	20–25
Sepsis	10–12	3–4	60–70	20
Intra-abd/SSTI	12–16	4–5	60–70	20
Clinical Considerations	Trough should not exceed 0.3 mcg/mL		Trough should not exceed 1 mcg/mL	

VI. Monitoring of serum levels and dosage adjustments

a. First-dose levels are **NOT** routinely needed

- First-dose levels may be indicated in patients with variable volume of distribution or unstable renal function (sepsis or post-operatively) to assess clearance

b. Serum levels should be performed routinely by day 3 of therapy **only once it has been determined that aminoglycoside therapy is to continue**

- Example: empiric therapy for sepsis from a UTI awaiting culture results does not require peak/trough levels**

c. Peak and trough serum levels: 1–2 hours post-end of infusion (peak) and immediately prior to the next dose

- Document actual time medication was hung
- Obtain peak level 1-2 hour post infusion (very important for distribution phase); 2 hr preferred if dose > 400 mg
- Use pharmacokinetic formulas (or www.globalrph.com “medical calculator”), to extrapolate peaks and troughs
- Extrapolated trough concentrations should not exceed 0.30 mg/mL
- Dosage or interval adjustments should be made at this time

d. Once stabilized, if therapy is to continue > 1 week, obtain the following laboratory values:

- SCr and BUN levels to monitor renal function (every other day)
- Peak and trough levels (efficacy and no toxicity), twice per week

e. If there is a suggested change in renal function **OR** other nephrotoxic agents (e.g., cisplatin, amphotericin B, pentamidine, vancomycin) are being used concurrently, more frequent levels of BUN, SCr, and monitoring may be necessary

BUN= Blood urea nitrogen; HDOD= high dose once daily; IBW= ideal body weight; SCr= Serum creatinine; SSTI= skin and soft tissue infection; UTI= Urinary tract infection

Antimicrobial Dosing Guidelines for Adult Patients Based on Renal Function

CrCl (mL/min)	STANDARD DOSE	MAXIMAL DOSE	HD
ACYCLOVIR IV >50 30-50 10-29 <10	5 mg/kg Q8H 5 mg/kg Q12H 5 mg/kg Q24H 2.5 mg/kg Q24H	10 mg/kg Q8H* 10 mg/kg Q12H* 10 mg/kg Q24H* 5 mg/kg Q24H*	D
Dose using ideal body weight *Use maximum dose for meningitis/encephalitis and varicella in immunocompromised host			
AMOXICILLIN PO > 30 10-29 <10	250 mg Q8H 250 mg Q12H 500 mg Q24H	500 mg Q8H 500 mg Q12H 500 mg Q24H	MD
AMOXICILLIN/CLAVULANATE PO > 30 10-29 <10	500 mg Q8-12H* 500 mg Q12H 500 mg Q24H	875 mg Q12H 875 mg Q12H 875 mg Q24H	MD
*Use 500 mg Q8H for osteomyelitis for CrCl ≥ 30 mL/min			
AMPICILLIN IV >50 30-50 10-29 <10	1 gm Q4-6H 1 gm Q8H 1 gm Q12H 1 gm Q24H	2 gm Q4-6H* 2 gm Q6-8H 2 gm Q8-12H 2 gm Q24H	MD
*Use 2 gm Q4H for meningitis			
AMPICILLIN/SULBACTAM IV >50 30-50 10-29 <10	1.5 gm Q6H 1.5 gm Q8H 1.5 gm Q12H 1.5 gm Q24H	3 gm Q6H* 3 gm Q8H* 3 gm Q12H* 3 gm Q24H*	MD
*Use 3 gm if penetration is an issue (abscess/diabetic foot /vascular insufficiency/osteomyelitis/intra-abdominal)			
AZTREONAM IV >50 30-50 10-29 <10	1 gm Q8H 1 gm Q12H 1 gm Q24H 500 mg Q24H	2 gm Q6H 1 gm Q8H 1 gm Q12 1 gm Q24H	MD
CEFAZOLIN IV >50 30-50 10-29 <10	1 gm Q8H 1 gm Q8H 1 gm Q12H 1 gm Q24H (2gm Q48H)	2 gm Q8H 2 gm Q8H 2 gm Q12H 2 gm Q24H	MD

Antimicrobial Dosing Guidelines for Adult Patients Based on Renal Function

CrCL (mL/min)	STANDARD DOSE	MAXIMAL DOSE	HD
CEFEPIME IV >50 30-50 10-29 <10	1 gm Q12H 1 gm Q24H 1 gm Q24H 0.5-1 gm Q24H	2 gm Q12H 2 gm Q24H 1 gm Q24H 1 gm Q24H	D
<u>Pseudomonal Coverage or Febrile Neutropenia:</u> >50: 2gm Q8H; 30-50: 2gm Q12H; 10-29: 1gm Q12H; < 10: 1gm Q24H			
CEFPODOXIME PO ≥30 <30 HD	100 – 200 mg Q12H 100 – 200 mg Q24H 100 – 200 mg 3 times per week	400 mg Q12H 400 mg Q24H 400 mg 3 times per week	MD
CEFUROXIME PO ≥20 < 20	250 mg Q12H 250 mg Q24H	500 mg Q12H 500 mg Q24H	MD
CEFTRIAXONE IV >50 <50-5 (INCLUDING HD)	1 gm Q24H No Change	2 gm Q24H* No Change	SD
*All indications are dosed at 1gm Q24H with the exception of meningitis (2 gm Q12H) and osteomyelitis (2 gm Q24H)			
CEPHALEXIN PO >30 10-29 <10	250 mg Q6H 250 mg Q8H 250 mg Q12H	500 mg Q6H 500 mg Q8H 500 mg Q12H	MD
CIPROFLOXACIN IV >30 10-29 <10	400 mg Q12H* 400 mg Q24H 400 mg Q24H	400 mg Q8H* 400 mg Q12H 400 mg Q24H	SD
*Use Q8H dosing only for <i>Pseudomonas aeruginosa</i>			
CIPROFLOXACIN PO >30 10-29 <10	500 mg Q12H 500 mg Q24H 250 mg Q24H	750 mg Q8H 750 mg Q12H 500 mg Q24H	SD
CLINDAMYCIN IV >50 <50	600 mg Q8H No Change	900 mg Q8H No Change	ND
CLINDAMYCIN PO >50 <50	300 – 450 mg Q8H No Change	450 mg Q6H No Change	ND

Antimicrobial Dosing Guidelines for Adult Patients Based on Renal Function

CrCl (mL/min)	STANDARD DOSE	MAXIMAL DOSE	HD
DICLOXACILLIN PO >50 <50	250 – 500 mg Q6H No Change	250 – 500 mg Q6H No Change	ND
DOXYCYCLINE PO >50 <50	100 mg Q12H No Change	100 mg Q12H No Change	ND
FLUCONAZOLE IV/PO* >30 10-29 <10	200 mg Q24H 100 mg Q24H 100 mg Q48H	400 mg Q24H** 200 mg Q24H 200 mg Q48H	MD
*RECOMMENDATIONS FOR SYSTEMIC INFECTION <u>ONLY</u> , NOT FUNGURIA. Give PO if patient has functioning GI tract **May require dosages up to 800 mg/d depending on <i>Candida</i> species/sensitivities			
GANCICLOVIR IV >50 30-50 10-29 <10	2.5-5*mg/kg Q24H 1.25 mg/kg Q24H 0.625 mg/kg Q24H 0.625 mg/kg Q48H	5 mg/kg Q12H 2.5 mg/kg Q24H 1.25 mg/kg Q24H 1.25 mg/kg Q48H	D
*5 mg/kg for CrCl ≥70 mL/min, 2.5 mg/kg for CrCl 50-69 mL/min			
GANCICLOVIR PO >50 30-50 10-29 <10	1 gm Q8H 1-1.5 gm Q24H 500 mg Q24H 500 mg Q48H		D
IMIPENEM/CILASTATIN >50 30-50 10-29 <10	500 mg Q6H 500 mg Q8H 500 mg Q12H 250 mg Q12H	1 gm Q6H* 500 mg Q6H* 500 mg Q8H* 500 mg Q12H*	MD
For suspected pseudomonas or ESBL infection use max doses			
MEROPENEM IV > 50 26 – 50 10 – 25 <10 OR HD*	1 gm Q8H 1 gm Q12H 500 mg Q12H 500 mg Q24H	2 gm Q8H 1 gm Q8H 1 gm Q12H 1 gm Q24H	MD
*If patient on HD schedule daily dose to be administered immediately <u>after</u> dialysis.			
METRONIDAZOLE IV/PO* >10 <10	500 mg Q8H 500 mg Q12H	500 mg Q8H 500 mg Q12H	MD
*No indication for Q6H dosing			

Antimicrobial Dosing Guidelines for Adult Patients Based on Renal Function

CrCL (mL/min)	STANDARD DOSE	MAXIMAL DOSE	HD
MOXIFLOXACIN IV/PO >50 <50	400 mg Q24H No Change	400 mg Q24H No Change	ND
NAFCILLIN/OXACILLIN >50 <50-5 (Including HD)	1 gm Q4H No Change	2 gm Q4H No Change	ND
NITROFURANTOIN* >50 <50	100 mg Q12H Not Recommended		N/A
*Do not use in systemic infections. Drug is ineffective with CrCl < 40mL/min due to inadequate urinary concentrations.			
OSELTAMIVIR PO > 60 >30-60 >10-30	75 mg Q12H 30 mg Q12H 30 mg Q24H	75 mg Q12H 30 mg Q12H 30 mg Q24H	N/A
PIPERACILLIN/TAZOBACTAM* >50 30-50 10-29 <10	3.375 gm Q6H 3.375 gm Q6H 3.375 gm Q8H 3.375 gm Q12H	3.375 gm Q4H 3.375 gm Q6H 3.375 gm Q6H 3.375 gm Q8H	MD
*Use for maximal dose for empiric therapy or treatment of <i>Pseudomonas aeruginosa</i> . If polymicrobial infection without <i>P. aeruginosa</i> is suspected, consider using ampicillin/sulbactam			
RIFAMPIN PO >10 <10	10 mg/kg Q24H 10 mg/kg Q24H	10 mg/kg Q12H 10 mg/kg Q24H	N/A
SULFAMETHOXAZOLE/ TRIMETHOPRIM IV >50 30-50 10-29 <10	<u>Non-PCP</u> 2.5 mg/kg Q12H 2.5 mg/kg Q12H 2.5 mg/kg Q12H 2.5 mg/kg Q24H	<u>PCP</u> 5 mg/kg Q6H 5 mg/kg Q6H 5 mg/kg Q12H 5 mg/kg Q24H*	MD
Dosing based on trimethoprim (TMP) component. *Avoid if possible, not recommended by manufacturer for CrCl <15 mL/min due to nephrolithiasis.			

Antimicrobial Dosing Guidelines for Adult Patients Based on Renal Function

CrCl (mL/min)	STANDARD DOSE	MAXIMAL DOSE	HD
SULFAMETHOXAZOLE/ TRIMETHOPRIM PO		(Equal to IV Dose)	MD
>50	1-2 DS Q8-12H	5 mg/kg Q6H	
30-50	1-2 DS Q12H	5 mg/kg Q6H	
10-29*	1-2 DS Q12H*	5 mg/kg Q12H*	
<10*	1-2 DS Q24H*	5 mg/kg Q24H*	
Dosing based on trimethoprim (TMP) component. Round to the nearest 160 mg of TMP component. *Not recommended by manufacturer for CrCl <15 mL/min due to nephrolithiasis			
VANCOMYCIN PO **			ND
>50	125 mg Q6H		
<50	No Change		
**For <i>C. difficile</i> only in patients with severe disease or failed metronidazole therapy			
*For IV dosing see vancomycin dosing guidelines			

Dosing based on Cockcroft and Gault Equation

D= Dialyzed 50 – 100%; HD= Hemodialysis; MD= Moderately dialyzed 20-49%; N/A= No information available;
ND= Not dialyzed 0-5%

Antimicrobial Duration of Therapy

INFECTIOUS DISEASE	RECOMMENDED DURATION OF THERAPY	STRENGTH OF RECOMMENDATION
<i>Clostridium difficile</i> Mild-moderate (initial episode) Severe, uncomplicated (initial episode) First recurrence (based on severity)	10 – 14 days (vancomycin) 10 – 14 days (vancomycin) 10 – 14 days	A-I B-I A-II (C-III)
Skin and Skin Structure Uncomplicated cellulitis Complicated MRSA (deeper soft tissue infections, surgical/traumatic wound infection, major abscesses, cellulitis, and infected ulcers and burns)	5 days (may require additional therapy depending on patient's response) 7-14 days (based on patient's response)	NA NA
Genitourinary Catheter-associated urinary tract infection Asymptomatic bacteriuria in a pregnant female Acute uncomplicated cystitis in an adult female	7 days if prompt resolution of symptoms OR 10-14 days for delayed clinical response 5 days if using levofloxacin in a patient who is not seriously ill 3 days in a female ≤ 65 years old without upper urinary tract symptoms after catheter has been removed 3 -7 days Nitrofurantoin: 5 days Trimethoprim-sulfamethoxazole: 3 days Fosfomycin: 1 dose	A-III B-III B-II A-III A-I A-I A-I
Intra-abdominal Established intra-abdominal infection where source control is achieved Acute stomach and proximal jejunal perforations where source control is achieved within 24 hours, in the absence of acid-reducing therapy or malignancy Acute appendicitis without evidence of perforation, abscess, or local peritonitis Bowel injuries attributable to penetrating, blunt, or iatrogenic trauma that are repaired within 12h and any other intraoperative contamination of the operative field by enteric contents	4-7 days 24 hours of therapy ≤24 hours ≤24 hours	A-III B-II A-I A-I

MRSA= Methicillin-Resistant *S. aureus*; NA= not applicable

Antimicrobial Duration of Therapy

INFECTIOUS DISEASE	RECOMMENDED DURATION OF THERAPY	STRENGTH OF RECOMMENDATION
Pneumonia Community-acquired pneumonia Hospital-acquired, ventilator-associated, and healthcare-associated pneumonia	Minimum of 5 days - Should be afebrile for 48–72 H AND have ≤ 1 associated sign of clinical instability before discontinuation of therapy 14 to 21 days - As short as 7 days, provided that the targeted pathogen is identified based on bronchoscopy and the etiologic pathogen is not <i>P. aeruginosa</i> , and that the patient has a good clinical response with resolution of clinical features of infection	B-I/II Level I
Diabetic Foot General recommendation Specific situations: Mild DFI Moderate to severe DFI (without osteomyelitis) Diabetic Foot Infection with Osteomyelitis	Continue antibiotic therapy until there is evidence that the infection has resolved but not necessarily until a wound has healed 1-2 weeks (though some require an additional 1-2 weeks) 2-4 weeks 4-6 weeks - shorter if entire infected bone is removed and probably longer if bone remains	 A-II A-II B-II
Catheter-related Bloodstream Infections (CRBSI) Uncomplicated CRBSI due to coagulase negative staphylococci other than <i>S. lugdunensis</i> (catheter removed) CRBSI with persistent bacteremia and fungemia > 72H following catheter removal, associated endocarditis, or supportive thrombophlebitis CRBSI with associated osteomyelitis Catheter-associated exit site or tunnel infection without associated bacteremia or fungemia	5-7 days OR observation alone (if no intravascular or orthopedic hardware is present and additional blood cultures are obtained after catheter withdrawal to confirm the absence of bacteremia) 4-6 weeks from first negative blood culture following catheter removal 6-8 weeks from first negative blood culture following catheter removal 7-10 days following catheter removal and incision and drainage (if indicated)	B-III C-III A-II for <i>S. aureus</i> ; C-III for other pathogens A-II A-II

CRBSI= Catheter-related Bloodstream Infections; DFI= Diabetic foot infections; H= hour(s)

Antimicrobial Duration of Therapy

This guidance is adopted from the National Antimicrobial Stewardship Taskforce

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IV to PO Antibiotic Step-Down Guidelines

Candidates for Antimicrobial Step-Down therapy:

- Patient is able to tolerate PO medication **AND** has a functioning GI tract
- The infection is treatable with oral antimicrobial therapy **AND** the indications and spectrum of activity are identical or similar between alternative drugs
- No evidence of malabsorption, dysphagia, or gastrointestinal bleed
- Patient is hemodynamically stable with improving body temperature and WBC
- High risk patients who **MAY NOT** be candidates for PO step-down may be identified by:
 - Pulse >125bpm
 - RR >30bpm
 - Systolic BP < 90 mmHg
 - T < 35°C OR >40°C, altered mental status

Contraindications to Antimicrobial Step-Down therapy:

- Serious infections concomitant with chemotherapy induced severe neutropenia
- Infections caused by resistant organisms (i.e. MRSA, VRE) unresponsive to >1 course of antimicrobials
- Situations where oral antimicrobials may not achieve adequate drug concentrations at the site of infection (i.e. meningitis, endocarditis)
- **Oral antimicrobial therapy may be used in neutropenic patients with negative blood cultures, temperatures < 38°C, and no indication of clinical sepsis**

Table 1. IV to PO Antimicrobial Step-Down Options

IV Antimicrobial	PO Antimicrobial
Ampicillin/sulbactam	Amoxicillin/clavulanate
Azithromycin	Azithromycin
Cefazolin/Ceftazidime	Cephalexin/Cephadrine
Ciprofloxacin	Ciprofloxacin*
Ceftriaxone	Cefpodoxime
Cefuroxime	Cefuroxime axetil
Clindamycin	Clindamycin*
Doxycycline	Doxycycline
Fluconazole	Fluconazole*
Moxifloxacin	Moxifloxacin *
Metronidazole	Metronidazole*
Nafcillin	Dicloxacillin
Trimethoprim/sulfamethoxazole	Trimethoprim/sulfamethoxazole*
<i>*Oral drugs which achieve serum levels similar to the parenteral dose form</i>	

BP= blood pressure; bpm= beats/ breaths per minute; GI= Gastrointestinal; IV= intravenous; MRSA= Methicillin-resistant Staphylococcus aureus; PO= by mouth; RR= Respiratory rate; T= temperature; VRE= Vancomycin-resistant enterococci; WBC= White blood cells

Twelve Steps to Prevent Antimicrobial Resistance

1. Wash your hands!
2. Vaccinate
3. Get the catheters out
4. Obtain cultures
5. Target the pathogen
6. Seek expert input
7. Know the local sensitivity patterns
8. Know when to say “**NO**” to broad spectrum agents
9. Treat infection - not colonization
10. Treat infection - not contamination
11. Stop treatment when infection is cured or unlikely
12. Prevent transmission



Adopted from the Centers for Disease Control Campaign for Clinicians

Contact Precautions

TYPES OF CONTACT PRECAUTIONS FOR INFECTION CONTROL

Precaution	Gowns	Gloves	Masks	Hands	Conditions
Standard	If splattering of body fluids or blood is likely	For contacts with mucous membranes, non-intact skin and ALL body fluids	If aerosolization or splattering of body fluids or blood is likely	WASH upon entering and leaving room	ALL patients

Use Standard Precautions on all patients. Use Transmission Based Precautions below in addition to Standard Precautions

CATEGORY SPECIFIC ISOLATION PRECAUTIONS/TRANSMISSION BASED PRECAUTIONS

Airborne	Not necessary	Not necessary	Approved, prefitted respirator protection and required N-95 mask	WASH upon entering and leaving room	Tuberculosis or rule out tuberculosis. Respiratory phase of measles and chicken pox
Contact	Upon entering patient room	Upon entering room and for all contacts with patient and surfaces or equipment in room	For suctioning, if organism is in sputum	WASH upon entering and leaving room	Infected or colonized patients, whether bedridden or ambulatory, with wounds or diarrhea: multi-resistant organisms, MRSA, VRE, <i>C. difficile</i> diarrhea or ESBL
Droplet	Not necessary	To handle respiratory secretions or suctioning	Within three feet of the patient (regular masks)	WASH upon entering and leaving room	MRSA in sputum, <i>Neisseria meningitidis</i> , drug resistant pneumococci, diphtheria, pertussis, influenza
Protective Environment	Not necessary	Not necessary	Not necessary	WASH upon entering and leaving room	Neutropenia (< 1000 neutrophils), ANC <100

Refer to Policy MCM 111-P26 Standard and Transmission Based Precautions
Call Infection Prevention and Control for further guidance at ext 2654

Pharmacokinetic Calculations

Ideal Body Weight (IBW) Calculation:

Male: 50 kg + [2.3 kg for each inch over 5 feet]

Female: 45 kg + [2.3 kg for each inch over 5 feet]

Creatinine Clearance (CrCl) using Cockcroft-Gault Equation:

Creatinine is expressed in mL/min

$$\text{CrCl (mL/min)} = \frac{(140 - \text{age}) (\text{IBW in kg})^*}{72 (\text{SCr in mg/dL})^\ddagger}$$

NOTE: For Females multiply by 0.85

CrCl for elderly patients or when no height is available:

$$\text{CrCl (mL/min)} = \frac{(114 - (0.8 * \text{age}))}{\text{SCr in mg/dL}^\ddagger}$$

NOTE: For females multiply by 0.9

*If patients actual body weight is less than IBW, use actual body weight to calculate CrCl

†If patient is underweight/cachectic, may consider rounding SCr up to 1 mg/dL.^{1,2}
Do not round to 1 mg/dL for all patients > 60 years of age.³⁻⁵

Adjusted Body Weight (aminoglycoside dosing)

Use adjusted body weight (AdjBW) when actual body weight (ABW) is ≥ 30% of ideal body weight (IBW)

$$\text{AdjBW} = 0.4 (\text{ABW} - \text{IBW}) + \text{IBW}$$

IBW= Ideal Body Weight (in kg); AdjBW= Adjusted Body Weight; ABW= Actual Body Weight; CrCl= Creatinine clearance;
SCr= serum creatinine

References:

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3. Bertino JS. Measured versus estimated creatinine clearance in patients with low serum creatinine values. *Ann Pharmacother*. 1993;27(12):1439-1442.
4. Smythe M, Hoffman J, Kizy K, Dmchowiski C. Estimating creatinine clearance in elderly patients with low serum creatinine concentrations. *Am J Hosp Pharm*. 1994;51(2):198-204.
5. Dowling TC, Wang E-S, Ferrucci L, Sorkin JD. Glomerular Filtration Rate Equations Overestimate Creatinine Clearance in Older Individuals Enrolled in the Baltimore Longitudinal Study on Aging: Impact on Renal Drug Dosing. *Pharmacotherapy*. 2013;33(9):912-921.

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